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ABSTRACT

A project that identified more than 1,200 academic and corporate research units within Pennsylvania is described, and a user's guide to the project's data file is provided. The Pennsylvania Research Inventory Project is an online data system designed to promote economic development, particularly within the Appalachian region of the state. The system provides information on personnel, organizational units, areas of specialization, level of activity, and facilities and equipment. The target audience is the business-oriented user, particularly those exploring new areas of activity or contemplating a change of location. Uses of the reference file include: generating specialized mailing lists, locating specialized research activities, identifying the sites of equipment and facilities, summarizing regional patterns of research, identifying individuals with specific competencies, and providing a cross-reference between academic and industrial research. The project employs the Stanford Public Information Retrieval Systems (SPIRES), which is described in the user's guide. Sample letters to research groups, survey forms, and standard industrial classification codes are appended. (SW)

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ED235700

AN INVENTORY OF RESEARCH UNITS IN PENNSYLVANIA
June 1983

THE TECHNICAL REPORT

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
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Prepared by:

William Toombs, Ph.D.
Robert Wilkinson, M.A.

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The Pennsylvania State University
University Park, Pennsylvania

and

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800 North Third Street
Harrisburg, Pennsylvania

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THE PENNSYLVANIA RESEARCH INVENTORY PROJECT

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EXECUTIVE SUMMARY

The published report of the Pennsylvania Inventory Project consists of a user document, List of Units and Index and The Technical Report. A third product of the Project is a current on-line data file continuously maintained at the State Data Center.

The Department of Commerce of the Commonwealth of Pennsylvania will provide purchasers with copies of the List of Units and Index, arrange access to the data file to answer requests, and provide information about other economic development programs. Contact:

Ron Kresge, Director
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Department of Commerce
410 Forum Building
Harrisburg, PA 17120
717-787-4088

The data set sought for this Project included the following information on each research unit: mailing address, director, areas of activity defined by SIC number, NCES category, and up to three keywords, size defined in terms of funding level and personnel, special equipment and facilities are specified.

The printed List of Units and Index can be accessed by geographic region, county, or SIC number. The on-line data set can be accessed by any of the basic information items.

There are 1179 research units in the List of Units and Index, 707 are located in the Appalachian Development Region.

The distinguishing features of this Inventory are: the use of research units rather than projects or researchers as the unit of study, the use of two standard typologies and a keyword set to identify areas of activity, the inclusion of specific indicators of size, the listing of special equipment, facilities, and affiliations.

The Pennsylvania Research Inventory Project is the result of collaborative efforts of the Pennsylvania Association of Colleges and Universities and the Center for the Study of Higher Education, The Pennsylvania State University. Valuable views on corporate research came from the Advisory Committee. The staffs of the Appalachian Regional Commission and the Department of Commerce provided consultation and suggestions.

A comprehensive search of federal sources for information on research activity at the level of the states produced limited results. Most federal information is not detailed enough for state purposes. To support

the formation of state policy in this and many other areas individual states will have to generate their own data.

Commercial directories, while useful as mailing list sources, do not have information that is sufficiently timely and precise to support policy decisions.

The 1179 entries in the printed List of Units and Index were gathered from 10,519 addressees. Most of these were businesses that might or might not have research units. Thus the collection effort was a "canvass" rather than a survey. In summary: 660 companies reported 695 research units, eight major universities reported 313 research units, and 36 four-year colleges reported 171 research units.

A telephone survey of ten other states and a review of recent literature shows the Pennsylvania Inventory to be unique in its scope, detail, and flexibility.

Information items were defined at a level of detail that encourages exchange and facilitates a rapid review of pertinent data. They are not intended to provide precise technical descriptions of research activity.

The full flexibility of the system, its primary value, can be realized only by widespread use. The published List of Units and Index can raise awareness of research resources in the business community. It is possible, technically, to dial-in on the computer file from any remote station and this direct access represents the ultimate use of this development tool.

The Pennsylvania Research Inventory Project
The Technical Report

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AN INVENTORY OF RESEARCH UNITS IN PENNSYLVANIA: JUNE 1983

The Technical Report

"A fine genius in his own country is like gold in the mine."
Poor Richard, Sept. 1733 (Ben Franklin)

In company with the comprehensive volume entitled, List of Research Units and Index, which is separately distributed, this document presents a final report on the Pennsylvania Research Inventory Project to the sponsors, The Ben Franklin Partnership Fund Board which replaced the Pennsylvania Science and Engineering Foundation (PSEF) and the Appalachian Regional Commission (ARC). The Technical Report contains a narrative on the project and its setting, a description of the project design, some discussion of the components for the information base, a review of the collection process, notes on the data management system including a users' guide, and an analysis of typical applications.

A. Narrative

1. The objectives were developed by consultation with the sponsors and through a review of user needs as interpreted by those who work with economic development policies on a day-to-day basis.

   a. Identify research capabilities within the Commonwealth and particularly the Appalachian region of the State.

   b. Create an information base that can be a development tool for coventuring among industries, businesses, institutions, and government.

   c. Identify areas of specialization to enhance the attraction of new enterprises and support of established businesses with high potential for growth.

d. Gather similar research information of value to the traditional core industries of the Commonwealth.

e. The technical dimensions will include an appropriate level of detailed information on:

1) personnel
2) organizational units
3) area of specialization
4) level of activity
5) facilities and equipment

f. Develop a capability for preparing "resource profiles" to compare existing conditions with other data such as, situations in "peer" states, or needs in high growth areas.

2. The Project and the Setting

Economic development has moved from a topic of general interest to an issue of necessity in most of the states that constitute the industrial core of the nation. Pennsylvania has introduced a broad band of initiatives to enhance and extend the favorable business climate that helped make the State an industrial leader. Thus, the comprehensive setting for the planning, execution, and application of this Project is the advancing new framework of economic development in the Commonwealth.

Economic development involves much more than research, however useful and sophisticated that resource may be, and the long range approach in the State recognizes the complexity of interchanges between the community, the economy, and the institutional structure. Essentially, the Pennsylvania design is built around three kinds of information. Through the use of econometric models and soundings of public opinion, the areas of potential growth and human needs have been combined into "directions" for the economy, communities, and resources. These alternative futures are contained in the series, Choices for Pennsylvanians published in 1980.

To not only identify but also to mobilize resources, Governor Thornburgh introduced in 1982 the Ben Franklin Partnership program. By

bringing interests and resources together in regional and statewide patterns, this new program moves from information to action.

A third component, represented in part by this Inventory, provides for the coordination of those special resources of all kinds already present in the Commonwealth. Information about financing options, tax benefits, venture capital sources, and the location of facilities is currently available through specialized offices of the Department of Commerce in Harrisburg and in the Economic Development Regions. In a related fashion the Appalachian Enterprise Development Initiative supports the efforts of enterprising businessmen.

Ready information about research activity in an easily usable form has been difficult to come by. The range of performers is wide and classification problems are formidable. Nevertheless, knowing where research of a particular type is going on holds high importance for an emerging economy that depends on technical revitalization of older businesses, advanced technology in new fields, and information-rich service enterprises. These conditions gave impetus to the Pennsylvania Research Inventory Project.

The initial interest came from a personal observation by the Governor, Dick Thornburgh, that even the small and remote research endeavor might contribute to some aspect of economic growth. The Pennsylvania Association of Colleges and Universities shared that interest. Familiar with the work at the Center for the Study of Higher Education on academic research in a variety of forms PACU opened discussion on a proposal that was favorably reviewed by the Pennsylvania Science and Engineering Foundation staff and shortly thereafter by the Appalachian Regional Commission.

For more than a decade members of the Center Staff have studied various aspects of research in academic settings. Toombs examined the relationship between sponsored research and doctoral study under an Office of Education grant in 1971. S. O. Ikenberry and Renee Friedman opened a study of research units which resulted in a book in 1972, Beyond Academic Departments.

In the mid '70s the Research Management Improvement Program of the National Science Foundation supported the study of research management and faculty involvement at Penn State by Sams, Toombs, Friedman, and others.

This project identified the climate of support necessary to encourage academic research. It displayed the variation in leadership styles and organizational forms that characterized university operations. Most recently Dr.Robert Friedman and Renee Friedman together with members of the Center staff reexamined the state of academic institutes, laboratories and centers across the nation reaching into many areas not covered by previous inquiries (The Role of University Organized Research Units in Academic Science 1982).

Out of this range of experience came an essential concept that was put to use in this Inventory project; the idea that identifying research activity in terms of organizational units has major advantages over other units of study. Most other summaries of research activity have fixed on either "projects" or the qualities of individual researchers as the target unit. Examples will be discussed in later paragraphs.

3. The Elusive Relationship

The relationship between research and economic development, between curiosity and production, is not entirely mysterious but neither is it entirely clear. For a century or more the unclear aspects of the exchange have fascinated active minds from a variety of backgrounds. In the last century industrial leaders along with financial magnates saw the most promising development of their age to be the conversion of scientific knowledge to practical benefit through the medium of technology. Men like Stephen van Rensselaer, Andrew Carnegie, John D. Rockefeller, William Barton Rogers, and Anthony J. Drexel founded or sponsored institutions, two in Pennsylvania, as evidence of their commitment to this linkage of research with the economy.

In other times the stimulus for looking at research has come from specific kinds of interests or needs. World War II and the following two decades laid down the configuration of research activity that dominates the U.S. scene;

a. Work is organized into "projects" with finite objectives, schedules, and resource commitments. In other countries formats for research take the form of national laboratories (France) or research institutes (Germany) which are continuously funded for

wide ranging exploration. Of course the United States has not neglected these forms, but the predominant activity is the research project.

b. Principal investigators, usually one or a few, have full responsibility for all phases of a project, management as well as performance.

c. Sponsor interests, often stimulated by researchers, shape the direction of research and focus the content of many projects.

Many features of industrial transition were encountered by Britain in the 1950s and 1960s. By the late 1960s the focus of study on how research can be turned to economic advantage both here in the U.S. and in Britain concentrated on process of "innovation," the path that leads from curiosity to production. From the studies of that era, particularly the work of Langrish (Wealth from Knowledge, 1972), the Illinois Institute of Technology Research Institute Study, TRACES (Technology in Retrospect and Critical Events in Science, 1968), the NSF publication by Marquis and Myers (Successful Industrial Innovation, 1970), Donald Schon's Technology and Change (1967), and Freeman's Success and Failure in Industrial Innovation (1972), a number of correlates of successful innovation emerged.

Briefly the findings can be summarized: There is a key person. Sometimes he is a product "champion," at other times a creative manager, or an entrepreneur. The need for a product or service, that is to say the market dimension including the potential, is recognized in the organization. Resources are available including venture capital, facilities, and manpower. Research and development, either in-house or outside, are operating efficiently to bring together strains of science and technology. Some of these attributes are now being rediscovered by comparisons between the recent experience of the United States and that of Japan and Germany.

At the present time many states are attempting to incorporate support for those elements favorable to the research-production relationship into comprehensive development programs. The situation is made more complex by

the fact that we are no longer dealing with simple linear trends. The economy is at a basic point of change so there are questions of which direction to take as well as the amount of commitment that is required. North Carolina and Massachusetts, each in its own way, have achieved forefront positions in such policy making. Pennsylvania, Michigan, Ohio, and New Jersey, faced with a more complex history, are working to create the catalysts that will accelerate economic development.

Most economic development programs have yielded few measurable results, according to critics, because they are not "politically responsive, research oriented, and information sensitive." The components of any economic development program are interrelated, thus a productive policy action is one in which significant changes are made simultaneously in a number of areas. Moderate, duplicative, contradictory, and uncoordinated changes in one or two policy areas are invariably costly and tend to be unproductive. At the present time the major components of state economic development programs include:

Investment and Capital Formation. Insufficient investment in buildings, plants, and equipment is seen as one of the major causes of economic stagnation. Thus, state governments' major policy actions for economic growth contain provision for venture capital to new business, provision for long-term investment for business expansion, and provision for technical and management assistance to small businesses. The construction of industrial parks and provision for joint ventures are also programs that make possible quicker and easier access to capital. When these programs are coordinated and regularly evaluated, "seed" capital resources will be available to advance technology.

Special Tax Incentives. Economic Recovery Tax laws have been promulgated at the federal and state levels to reduce the tax burdens on individuals and corporations, and consequently increase savings and investment in capital, new technology and products. At the federal level, the Economic Recovery Tax Act of 1981 and the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982, have far reaching potential for the nation's economic development. These tax incentives range from outright exemptions on certain taxes, e.g. property, sales and inventories, through

severance or lower taxes, to investment tax credits for property, buildings and equipment.

Modification of Government Regulations. Regulations often reflect a distrust of corporations. Attempts by the governmental bodies to introduce policies that improve the environment (air, water, and parks), increase product and consumer safety, insure equal opportunity enforcement, and keep consumer costs down have been numerous in the last twenty years and not always coordinated. Compliance costs to business are very high (a staggering $120 billion in 1980.) Such costs can reduce investment capability and overseas competitiveness. In order to reduce both the administrative and compliance costs, federal and state governments are reconsidering regulations and antitrust laws to reduce duplication or conflicting standards in issuing rules and permits. The elimination of such contradictory and duplicative regulations and procedures will ehnance industrial capability to invest in high-risk technological products.

Research and Development. According to Edward Denison, about 50 percent of U. S. measurable economic growth between 1948 and 1969 derived from advances in new knowledge. Recently, the Committee for Economic Development has contended that a slowdown in research and development growth accounts for between 10 and 18 percent of U. S. decline in economic productivity. Consistent, stable, and increasing financial support for research and development provide a stronger basis for technological innovation and economic growth. Thus the present joint venture among government-universities-industries in basic and applied research, exchange of research personnel, and sharing of high-cost scientific equipment portend a stronger economic future. But whereas industries primarily invest more in product improvement or line extension studies, the burden of basic research still rests with the federal and state governments. The complementary relationship between basic research and the education of engineers and scientists is also significant, as noted below. The Economic Recovery Tax Act of 1981 and various state tax laws provide for tax credits to individuals and businesses that support research.

Human Resources Development. The development of human resources by broad education and specific training programs represents a realistic and reliable contributor to economic development. Both Adam Smith and Alfred Marshall stressed the importance of education in the process of development, and in 1960, Theodore W. Schultz pointed out "the failure to treat human resources as a form of capital, as a produced means of production, as the product of investment." While the 1960s and 1970s witnessed the growth of trained/skilled labor, the knowledge/information society that we now encounter calls for a broader, more flexible and technologically-oriented education of the labor force. Constant changes in industrial management, production, and sales techniques call for a better educated labor force. A comprehensive flexible education and training program embracing elementary and secondary schools, two- and four-year colleges, and on-the-job training activities gives a state an advantage in attracting new business. Specific attention must be given to the education or reeducation of minority groups, women and young workers who are poorly skilled to meet the requirements of technologically advanced industries.

Infrastructual Development. Transportation of goods and services, and the communication of information are essential both at the beginning and end of the production system. The state of the transportation system --rails, roads, bridges, waterways, and air facilities--can impede or enhance economic growth. Housing and living amenities for the majority of the labor force, health, school, and recreational facilities for the workers and their families, are infrastructural facilities that communities offer as their part in economic development. Other elements in the infrastructure are the energy sources and power networks, always with cost as a prime factor, the availability of water and waste disposal facilities, the services for public safety, fire and police, and a good range of human services, health, social science, along with education.

Modification of Financial and Legal Systems. Statutes and banking regulations and procedures are often outdated, and sometimes even obstructive to the first steps of economic growth. Such laws and regulations can fall more heavily on the small but technologically

innovative firms that are just starting. In Pennsylvania, the Governor has called on various lending and commercial institutions to review or revamp those rules and procedures that may hinder small and new businesses.

Pennsylvania has an array of options under each of these general headings to support the introduction of new enterprises. They are coordinated, as is the use of this Inventory by the Department of Commerce.

B. Project Design

1. The Central Concepts

The initial meetings between Project Staff and the Pennsylvania Association of Colleges and Universities representatives laid out the essential features of the study and stipulated the key questions. The unit of study is an organizational component that is involved with particular areas of research overall an extended period of time. The information elements would have to be complete enough to allow rapid communication, permit both standard and idiosyncratic classifications, convey a sense of size and scope, and record any specialized equipment facilities, and relationships. The target audience is the business-oriented user, the producer and manager, particularly those who are exploring new areas of activity or contemplating a change in location.

From the start it was clear that a product more accessible and more flexible than a printed volume was desirable. The main emphasis went to the construction of full information base of high quality. This could be translated into several forms depending on the interests of the user. A printed catalogue of research units has one big advantage, the advantage of easy availability. A consultant-guided inquiry system to the computer file can link printouts on research to other kinds of economic development information also promises high utility. Eventually, direct access to the file by keyboard-based inquiry procedures available to a variety of offices and agenices is entirely feasible.

2. Key Questions

a. How much of the essential information has been gathered and collated by other agencies? Is it convertible to the purposes of this Project?

The National Science Foundation was a logical starting point not only because of the extended interest in the processes of innovation and diffusion but also because of the rich data sources it generates. The Foundation conducts studies on its own or under contract but it also acts as an informal, and sometimes formal, clearinghouse for research conducted elsewhere. The Survey of Industrial Research and Development appeared to hold promise for this project if the results could be disaggregated by state. As it turned out the data are derived from U.S. Census surveys which carried the limitations noted below. The generally useful academic data files collected by NSF every fall from institutions are both timely and accurate. The Survey of Scientific and Engineering Personnel Employed by Colleges and Universities and the Survey of Graduates Science Students and Postdoctorates could provide some useful information on academic research but nothing on industrial activity. Fortunately NSF had collated all its data on amounts of research grants, origins, and performers by institution for several recent years. This unpublished listing enabled us to present academic institutions with the extant data on public file about their research endeavors. The Foundation data also led us to the National Research Council efforts on the Survey of Current Doctorates and the Earned Doctorate Survey. Each file was too narrow in scope to serve the interests of economic development of Pennsylvania, in the first instance because the sample was too small, in the second because of large banks of missing data about employment among the new doctorates.

The Bureau of the Census is, of course, a major source of business data, much of it derived from samples drawn from the Standard Statistical Establishment Listing (SSEL). This sample pool is reconstructed every five years. By way of example the industrial R & D data for NSF is based on returns of the RD-1 form, a rather complete statement on expenditure, by 1500 establishments. To the limitations of sampling we now added the limitations of confidentiality proscribed by the Federal Code to protect

those who give proprietary information to national studies. In other agencies the Higher Education General Information Survey (HEGIS) was examined along with the Securities and Exchange Commissions to check existing data against Pennsylvania's needs. The SSIE conceived by the Smithsonian Institution was a major depository for information on research projects. Ready access through library channels was one of the valued features. By the time of our inquiry the data file was no longer maintained and the fund of information had been transferred to the National Trade Information Service at the Federal Department of Commerce.

In summary, three limitations blocked the selection and the use of existing data files for the Pennsylvania Inventory. Much of the usable information was confidential under the Federal code. Many of the studies were based on national samples that did not disaggregate to the State level. The terminology and data items did not correspond with the requirements of a general information program.

Another source of information about research activities is found in the commercial directories. We examined the principal publications of Jaques Cattell Press, Industrial Research Laboratores (17th edition) and Medical Sciences Research Programs (Bowker, N.Y., 1982). The alpha lists are indexed by geographic location, names of key personnel and topic. This last index in this work followed a common sense categorization rather than a formal typology. Entries were concise showing two key descriptors and general categories of personnel. These documents are shaped to mailing label needs and we used Industrial Research Laboratories and the Medical Sciences volume, to generate part of our mailing list. The 7th edition of the Research Centers Directory, two volumes, by Gale Research Company was also reviewed. Entries are grouped under fourteen major categories, not a standard typology, and indexed by institution, subject matter, and alpha sequence. The content of each entry is variable under subheadings of "governance," "research activities and fields," "publications and service." The Dun and Bradstreet file of active businesses was also examined.

A very flexible file of research projects is maintained by Control Data Corporation in its Cybernet Services. It is an expensive subscription search service that can provide quickly a great deal of information about research in a specialized area.

The Control Data information handling system when coupled with LEXITEC and TECHNOTEC procedures presented an attractive possibility. Unfortunately the system is wholly maintained by Control Data and the software was not available at that time on lease or purchase.

For Pennsylvania alone the new version of the Pennsylvania Industrial Directory, then in press at Harris Publishing Company, provided the most up to date addresses but insufficient data to identify research groups. Among the Pennsylvania State agencies careful attention was given to the Legislative Office of Research Liaison (LORL) which maintains a file of research projects at major university research centers. Within the State other listings of employers, taxable businesses, and corporate registrations were searched to ascertain whether research efforts could be separately identified.

The conclusion reached after this search of federal, state, and commercial directories was that any separate listing of research would have to be developed on its own base. The implication of this conclusion is also important. It now appears that most states, as they face policy-making issues, must create their own data sets to achieve the necessary degree of accuracy and detail. By June 1982, it was decided that a survey of the academic and corporate sectors was required.

b. What are the critical information items needed to describe research efforts?

From previous studies at the Center for the Study of Higher Education it was possible to construct a list of approximately thirty items that could be used as descriptors. For each "descriptor" a series of "indicators" was developed and then the primary and secondary sources of such information items were identified. Consultation with the Department of Commerce on how the file would eventually be used helped to sharpen the focus. A survey form containing about twelve categories was outlined to include: 1) precise information for mail and phone communication, five items; 2) one open ended descriptive statement on the major focus of the unit; 3) items to permit standard classification and cross reference by SIC, NCES, Academic Program Codes, and keyword; 4) numbers and types of personnel; 5) annual funding level, these two being indicators of size;

and 6) details on special equipment, libraries, and facilities (See Appendix). By August 1982, a first draft of the survey instrument was ready for test. It was decided to use the two- and four-year colleges in Pennsylvania as the test population. At the same time copies of the corporate materials, cover letter and form, went to the advisory committee for criticism.

c. What population should be surveyed and what design should be followed?

It was clear from the outset that research activity could be found in three settings; colleges and universities, some but not all corporations, and a mixed group that included non-profit entities, medical schools, specialized commercial research enterprises, and government agencies. These groups are so different in composition that it was decided to develop separate mailing lists for each. The mailing lists were constructed in each case by careful screening and cross-referencing of various sources. As noted above the two- and four-year colleges were used as the first survey group. The comprehensive list maintained by the Pennsylvania Association of Colleges and Universities was reduced to 104 by removing seminaries, music schools, and other institutions unlikely to have research of interest to business development. Details are provided later in the report. Materials were sent to colleges in September and October 1982. The universities were visited in November and December and the medical schools in January 1983. The first corporate mailings went out in December and the process was completed by March. Special follow-ups and revisions continued into June 1983, and it can be concluded that the survey process took nine months.

d. How can the data file be constructed, corrected, and accessed?

Several alternative data handling methods were under consideration at the time of the initial proposal. All of them would have resulted in an adequate record file but the central issue was flexibility. Floppy disk and hard disk files for microprocessors could have been used but the

number of potential entries would produce an unwieldy storage and indexing problem.

The exploration turned up several special systems under development that would eventually be usable. Finally a trial approach with SPIRES, Stanford Public Information Retrieval Systems, was undertaken. This is a copyright product (1982) obtainable from the Board of Trustees of the Leland Stanford, Junior, University. It exceeded our requirements for flexibility and met our criteria for user convenience in every respect. This system was in place by October 1982 and became the basic working program throughout the Project. All responses were immediately entered into the SPIRES file and, with only a few exceptions, data transformations and rearrangements were made within the system. It offers easy entry, flexible formating, simple updating and correction, and a rich choice of outputs. In the case of this Inventory the data file can be addressed and searched along as many as nineteen different indexes. Only four are presented in the printed inventory, alpha by sponsor, geographic region, county, and standard industrial code.

It is possible to off load the file onto a tape that is labeled for use in another data system. This is not a routine function nor is it universally compatible so the work must be carefully verified. A "Users Guide" specifically designed for this Project on SPIRES is provided in the Appendix.

We turn now to a more detailed consideration of each of these areas, the information base, the populations and collection process, and the data management system.

C. The Information Base

It has often been observed that a researcher is hostage to either the questions or the answers. Getting good hard, specific answers requires the construction of questions that leave out a great deal of what one would like to know. Penetrating questions, on the other hand, are likely to produce a range of answers that do not always hold together. In looking at the information needed for an inventory of research the compromises were always made in the direction of clarity for the potential users.

1. The Unit of Analysis

For this project the unit of analysis is a coherent, organized, research effort, that is to say a component of the organization. Other studies and listings concentrate information around the individual researcher, his or her interests, capabilities, or current work. This approach is commonly used by universities and medical schools. We found this kind of information at the University of Pennsylvania, Thomas Jefferson University and Hahneman Medical School.

Another common method of cataloguing research is by project title or content. The widespread practice on the part of federal agencies, corporate sponsors, and foundations of identifying single projects with responsibility lodged with principal investigators makes this approach to cataloguing research appear to be the most practicable. The limitations appear as one looks across a spectrum of activities over time. It then becomes clear that project listings are often redundant with overlapping aspects separated merely to accommodate different sponsor interests. Projects, and researcher interests as well, are changeable. The perishable nature of the data arises from the fact that most projects have a funding life of about three years. Updating costs are high and continuous file maintanence is usually required. Inventories of faculties and equipment offer a more durable record but they tell little about what is going on.

Organizational units, on the other hand, can be defined to cover a broad range of efforts extending from the committed individual researcher at work on a single theme for a long time to a major industrial R&D lab. The criteria for inclusion in the Inventory were focus of interest, specialized knowledge or technique, discrete funding or other support, and distinctive products or outcomes.

Even the term "research" cannot be accepted as self evident. The Advisory Committee recommended that the more general term "research and development" be used in communications with the corporate sector. Very early in our considerations any notion of breaking research into subcategories such as "basic" and "applied" was put aside as too conflicted.

2. Location

A second question dealt with the appropriate combination of descriptors to identify location and address. Because communication, precise and rapid communication, is of major interest to users the simple mail address was expanded. The sponsoring institution, agency, or company was identified. The name of the current director was included along with a telephone number.

3. Typology

Possibly the most puzzling dilemna in the construction of the survey and the data base was how to identify what research activity was going on. Typologies, however convenient, are seldom more than an introduction to a complex topic. Fortunately there were two typologies, one old and one new, that would permit respondent to span the academic and the industrial sector. The Standard Industrial Code (SIC) is widely used and well established in the business world but neglected by academic researchers. Customarily, corporations use a four digit SIC code but to conserve space and increase the possibility of cross-reference we used only a three digit level of SIC.

At the same time a new code intended for general use in all government agencies was introuced in 1982. The NCES Program Code is a mixture of disciplines and academic programs, comprehensive in scope if unfamiliar. By having all respondents use both classifications to describe their work we have achieved a kind of "cross walk" between two separate nomenclatures, the academic and the industrial.

Typology alone could not give a good description even though it simplified access to the Inventory. Respondents were asked, therefore, to give three descriptive keywords arising from their research activity. These keywords free the information file from the limitations of knowledge that might be imposed if the Project staff tried to interpret, reclassify or explain a technical description. The specialist can address other specialist through the medium of keywords without expecting distortion from an interpolator who has to reclassify terms that are unfamiliar.

A statement describing the "major focus of the unit" was requested but not coded into the data file. If needed, this information would have

provided a cross check or verification on the selection of NCES and SIC codes.

4. Size

Estimations of size are important and the level of research sophistication is also useful. By identifying the numbers of personnel of various kinds attached to a unit the user can draw inferences about competence. Size is indicated by numbers of personnel and by annual levels of funding, both items on the survey. As it turned out this information had a special value. Some companies will not release information on research funding. Others withhold detailed data on personnel but with one or the other a user can get a picture of the size of the research unit. A number of respondents declined to provide detailed information on the level of activity noting that proprietary interests and security requirements laid down by company policy could not be modified.

5. Facilities

Equipment and facilities have become a major factor in scientific research. The question asked for "special" resources and, as it turned out, this was easily interpreted by respondents. We received almost no inquiries about how to answer this. One can conclude that people in the field know what "state-of-the-art" is and can readily designate advanced equipment.

One of the most interesting categories for future analysis deals with "cooperative arrangements." An abbreviated record of responses is entered on the data file but the full significance can come only through more detailed examination.

The final item, a statement of willingness to cooperate, was not entered into the data file but showed this response pattern: 681 "yes", 183 "no", the remainder, no answer.

D. The Collection Phase

1. The Key Research Populations

As noted above at least four separate populations were originally identified, corporations, colleges, non-profit research groups, and universities. The corporate group was split to give a total of five. Slightly different collection techniques were used in each case.

There are 186 collegiate level institutions in Pennsylvania according to the Department of Education. Because of size or special programs many would not have research units of the type sought. Theological seminars (16) other small religious schools (9) specialized professional and single purpose institutions, Dickinson Law School for example, (12), and preparatory schools (35) were removed to give a net academic sample of 114 institutions.

This was divided into 104 collegiate institutions and 10 major research institutions. The colleges were used as a pilot test. The mail out was followed over six weeks by telephone reminders and verification. Careful attention was given to all questions. Four colleges elected not to participate so the response rate was 97 percent. Among respondents 36 colleges reported research in a total of 171 units.

2. The Collection Process

For each of the major universities and research medical schools a set of response forms partially completed from public data, mainly the NSF institutional profiles, was prepared. These were delivered in person to the university officer with designated responsibility in the research area. Two options for collection were presented. (1) The research office of the institution could distribute and collect the forms and return them to the Project office. (2) The institution could provide a list and the Project staff would contact the units directly. All the research institutions saw internal benefits to a timely data set on research. All but one elected to control reporting from a central office. The University of Pennsylvania was in the middle of an inventory of faculty. They elected to distribute the forms internally then provide us with a list, and leave the follow-up to the Project office. At the present time all university level institutions have responded and 332 research units

are listed of which eight universities totaling 313 units are listed in the List of Research Units and Index. Feedback printouts were provided for verification and for internal records at each institution.

A mixed category of special research laboratories was constructed from the membership list of the American Council of Independent Laboratories, and from the commercial publications Industrial Research Laboratories and Medical Research Laboratories. The population in this group totaled 862. This list was joined to the corporate mailing and the responses are not separately reported.

Construction of the corporate mailing list was a complex task. The basic documentation was an updated and carefully maintained list of Pennsylvania manufacturers available through Continuing Education at Penn State. Although the basis for this was the Commerce Register file and the modified list contained 12,999 addresses all did not fit the Project needs. A special printout of employers by size of company was obtained from the Pennsylvania Bureau of Employment Security, 2,803 entries. By hand selection these lists were merged to give two corporate populations.

Large corporations, those with more than 500 employees, were viewed as likely to have research facilities. Provisions for two mailings were made, initial and reminders. The research laboratories list was joined here to give the Corporate I file a total of 3,313.

Corporations with employees numbering 25 to 499 were designated as Corporate II. The total number in this category was 7,206. Only a single mailing went to this population but a letter from the Secretary of Commerce emphasizing the interest of the Commonwealth in business development was enclosed.

From these corporate mailings a total of 703 research units have been reported of which 695 are in the printed Inventory. Because of the complexity of some large companies, Westinghouse and General Electric for example, special sub-routines for collection have been worked out and the final material is not yet in. The number of entries in the printed catalogue is 1179.

Because of the transitory nature of the information and the hand work connected with merging sources there is no single collated label list.

What we do have is the information and sequence for replicating the mailing process. It is schematically displayed in Figures 1 and 2.

E. Findings

1. Response

In reading this section of the report, the special characteristics of the Inventory must be kept in mind. It was not a sample study, but an effort to capture all units of a certain type. Those units, research units, overlap with similar but not exactly identical units such as certification and testing laboratories, which often carry a research title. The universe of research units we are approaching is unknown in its essential dimensions, number and size of unit. We surveyed a larger population, that of businesses which might have research units. Finally, the Inventory is conceived and designed as an information system to be corrected and expanded as new data is gathered.

For all the above reasons it is not possible to calculate a response rate for the survey in a conventional way. Nevertheless, it is desirable to have some approximation of how many units from the total business population have been gathered by this first cast of the survey net. From the commercial listing of Industrial Research Laboratories a random list of 100 entries was selected from the Pennsylvania listings. These are, of course, known research units of various sizes. These were checked against responses to the Inventory survey. From the 100 entries a total of 31 survey responses were received. In that group of replies 2 reported to us they had no research units even though they were listed in a research directory and 29 sent in the survey form information. Based on experience with the universities and medical schools we believe that a large number of the addresses in the IRL Volume are no longer active. Allowing for the fact that the list contains inappropriate addresses and, as well, for the units that are still preparing data, our best estimate is that we have identified about 60 percent of the research units in the state.

Turning to other features: A total of 10,519 corporate contacts were made by mail or visitation. As of August 1, 1983 the number of units identified totaled 1225. These have been entered in the main data file.

Figure 1

CORPORATE MAILING LIST

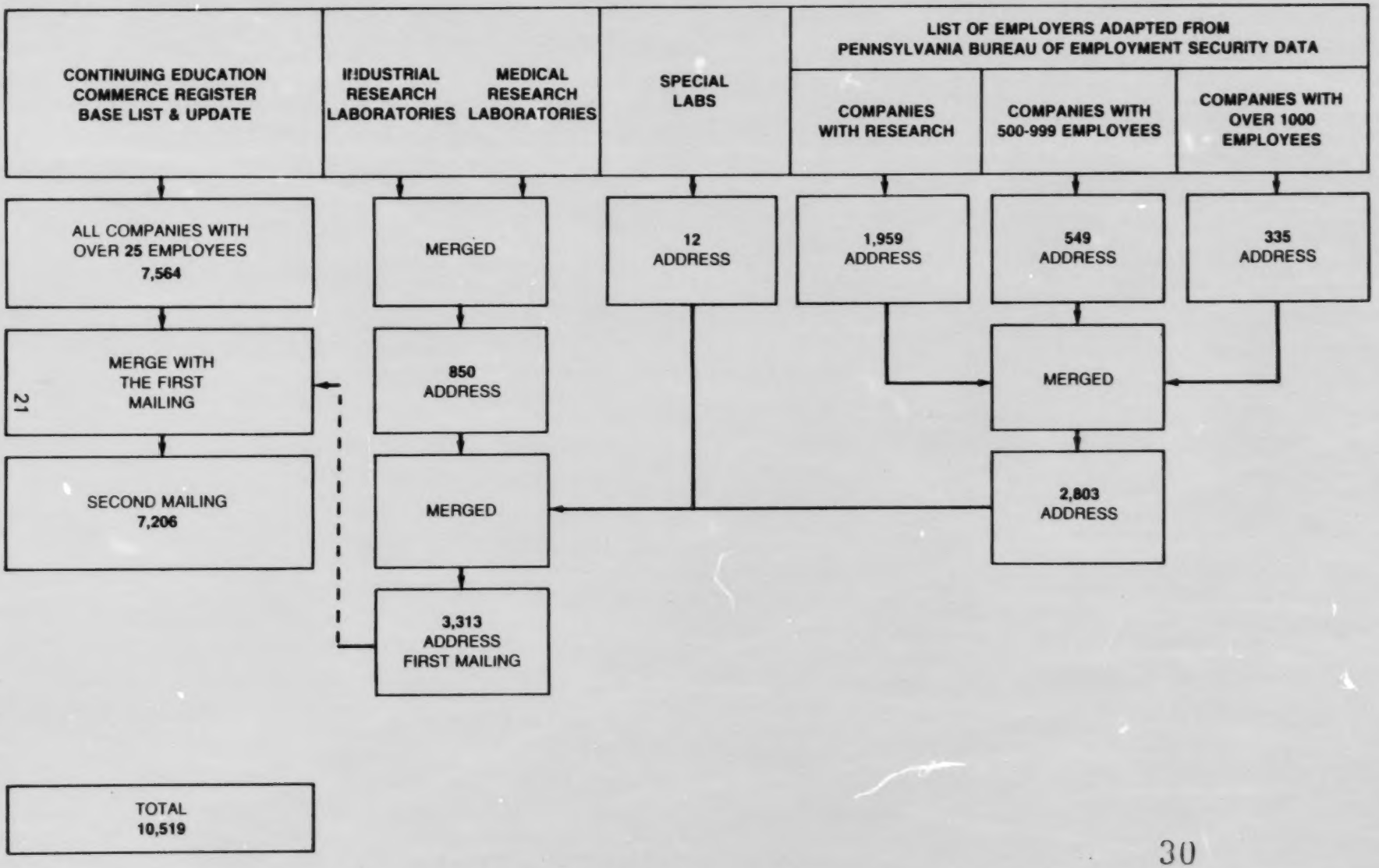

Figure 2

PENNSYLVANIA RESEARCH INVENTORY PROJECT
THREE PHASES IN COLLECTION OF INFORMATION

	COLLEGES	MAJOR RESEARCH UNIVERSITIES	CORPORATE SECTOR
TOTAL #	**102** COLLEGES	**9** RESEARCH UNIVERSITIES	'KNOWN RESEARCH' **3,313** 'UNKNOWN RESEARCH' **7,206**
MATERIALS	— LETTER TO THE PRESIDENT — DESCRIPTION OF THE PROJECT — SURVEY FORM	— LETTER TO THE PRESIDENT — DESCRIPTION OF THE PROJECT — SURVEY FORM FOR EACH OF THE IDENTIFIED RESEARCH UNIT	— LETTER TO THE CHIEF EXECUTIVE OFFICER — DESCRIPTION OF THE PROJECT — SURVEY FORM
PROCEDURES	— MAILING — REMINDER LETTER — TELEPHONE FOLLOW-UP VERIFIED	— VISITING THE CAMPUSES — TELEPHONE FOLLOW-UP VERIFIED	— MAILING — FOLLOW-UP 'KNOWN RESEARCH' GROUP

The printed version of the Inventory contains 1179 entries reflecting the state of the data file on June 1, 1983.

2. Distribution by Type of Performer

Where the entries are categorized by the type of organization performing the research the following distribution results:

> Among the 104 four-year colleges surveyed, 36 institutions reported research units for a total of 171 coherent research units.
>
> The eight major universities in the State responding by June 1, 1983, recorded 313 research units and we know this list is not yet complete.
>
> Corporations identifying active research units within the organization total 660 companies. They reported 695 separate units.

3. Geographic Distribution

Of the 1179 units in the printed Inventory, 29 are located out-of-state but, of course, they do business in the Commonwealth. Among the 1150 located in-state a total of 707 are found within the Appalachian Region. The distribution among regions is quite variable as one would expect in a State with the population distribution pattern typical of Pennsylvania. On the accompanying Chart, Figure 3, the geographical distribution is displayed.

4. Standard Industrial Code (SIC) Profiles

Some indication of economic emphases can be gained by presenting the frequency pattern for two-digit SIC codes. These are shown for the State as a whole in Figure 4 and for regions in Table 1.

F. Approaches In Other States

1. Assessing Research Capability

The question of how much research potential there is within the boundaries of a state is not new even though its importance for economic

Figure 3

PENNSYLVANIA RESEARCH INVENTORY, GEOGRAPHICAL DISTRIBUTION OF RESEARCH UNITS BY DEVELOPMENT REGIONS

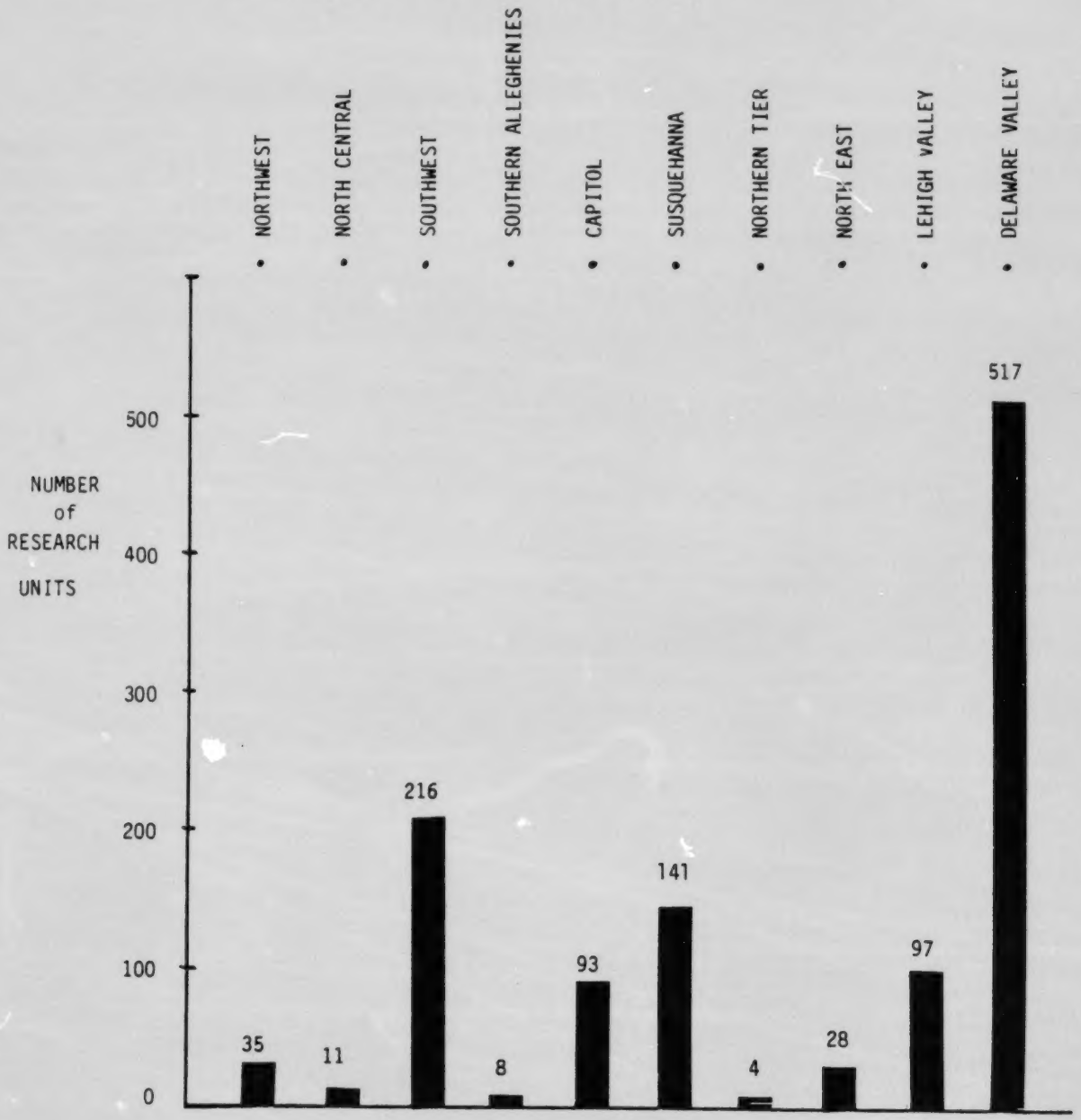

Figure 4

DISTRIBUTION OF UNITS
BY
TWO DIGIT SIC CODE

Pennsylvania Research Inventory Project

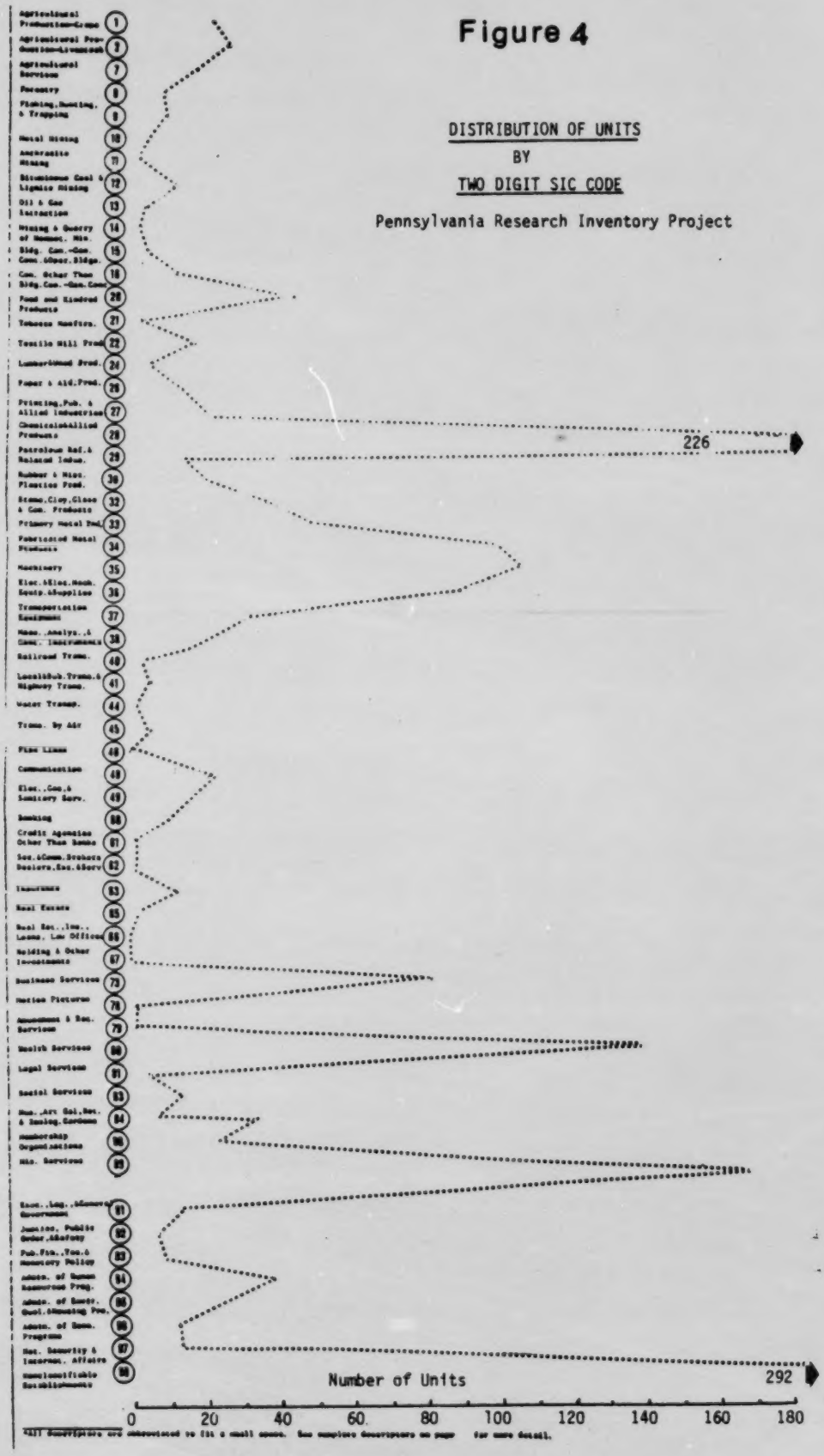

TABLE 1

Major SIC Categories	Out of State	Capitol	Delaware Valley	Lehigh Valley	North Central	Northeast	Northern Tier	Northwest	Southern Alleghenies	Southwest	Susquehanna	Total
Agricultural Production-Crops (1)		2	2							2	17	23
Agricultural Production-Livestock (2)		3	3								21	28
Agricultural Services (7)			2	2					1	2	12	19
Forestry (8)			1					1		1	2	5
Fishing, Hunting, & Trapping (9)	1	1	2			2		2			2	10
Metal Mining (10)	1		1	1		1				2		6
Anthracite Mining (11)	1	1						1		1		4
Bituminous Coal & Lignite Mining (12)		1		1				1		7	3	13
Oil & Gas Extraction (13)	1		1		1					1	2	6
Mining & Quarry of Nonmet. Min. (14)			2		1						1	4
Bldg. Con.-Gen. Cont.&Oper.Bldgs. (15)	1		3		1						1	6
Con. Other Than Bldg.Con.-Gen.Cont (16)		1	3	2						3	3	13
Food and Kindred Products (20)	3	10	11	6				1		4	9	45
Tobacco Manftrs. (21)	1	3										4
Textile Mill Prod (22)	2	6	7	2		1				1		19
Lumber&Wood Prod. (24)		1	2							1	2	6
Paper & Ald;Prod. (26)		2	6		2	1		4				15
Printing,Pub. & Allied Industries (27)		2	14	2						4		22
Chemicals&Allied Products (28)	4	14	87	38	1	7		11		50	14	226
Petroleum Ref.& Related Indus. (29)	1	2	5	1	1			1		3	2	16
Rubber & Misc. Plastics Prod. (30)	3	11	2		2					3	1	22
Stone,Clay,Glass (32)					1	1		1		15	4	38

Printing,Pub. & Allied Industries	27		2	14	2						4		22
Chemicals&Allied Products	28	4	14	87	38	1	7	11		50	14		226
Petroleum Ref.& Related Indus.	29	1	2	5	1	1		1		3	2		16
Rubber & Misc. Plastics Prod.	30	3	11	2		2				3	1		22
Stone,Clay,Glass & Con. Products	32	1	4	8	3	1	1	1		15	4		38
Primary Metal Ind.	33		1	4	9		3	3		25			45
Fabricated Metal Products	34	1	14	27	14	1	7	8		23	6		101
Machinery	35	3	15	27	11	1	2	4	2	32	10		107
Elec.&Elec.Mach. Equip.&Supplies	36	2	6	35	7	6	3	5		17	10		91
Transportation Equipment	37		1	20	2			1	1	5	4		34
Meas.,Analyz.,& Cont. Instruments	38	1	3	43	8	2	1	4		21	22		105
Railroad Trans.	40			2			1	1			1		5
Local&Sub.Trans.& Highway Trans.	41			3				1		1	1		6
Water Transp.	44			2							1		3
Trans. By Air	45	1		3					1				5
Pipe Lines	46									1			1
Communication	48		1	14	3		1			1	2		22
Elec.,Gas,& Sanitary Serv.	49	2		8	4					2	2		18
Banking	60		1	5	1		3			1			11
Credit Agencies Other Than Banks	61			1						1			2
Sec.&Comm.Brokers Dealers,Exc.&Serv	62			3									3
Insurance	63	3	2	7									12
Real Estate	65		1	2							1		4
Real Est.,Ins., Loans, Law Offices	66			1									1
Holding & Other Investments	67			1									1

	65		1	2							1	4
Real Estate												
Real Est.,Ins., Loans, Law Offices	66			1								1
Holding & Other Investments	67			1								1
Business Services	73	5	2	52	6	1	1	2	1	6	7	83
Motion Pictures	78			2								2
Amusement & Rec. Services	79			1							1	2
Health Services	80		4	81	11			7	3	21	12	139
Legal Services	81			3						1	1	5
Social Services	83		1	11					1		1	14
Mus.,Art Gal,Bot. & Zoolog.Gardens	84		2	4							1	7
Membership Organizations	86		5	8	4		1			4	2	24
Mis. Services	89	4	6	69	19		3	3		38	31	173
	90											
Exec.,Leg.,&General Government	91		3	7						2	2	14
Justice, Public Order,&Safety	92			1				2		2	2	7
Pub.Fin.,Tax.& Monetary Policy	93		1	1	1			1		1	4	9
Admin. of Human Resources Prog.	94		2	21			3	1	1	2	8	38
Admin. of Envir. Qual.&Housing Pro.	95	1	2	8	3		1		2	2	6	25
Admin. of Econ. Programs	96		2	5			1			1	3	12
Nat. Security & Internat. Affairs	97			6				1		2	2	12
Nonclassifiable Establishments	99	10	31	164	13		3	3	2	1	45	20	292

*All descriptors are abbreviated to fit a small space. See complete descriptors on page for more detail.

development now places the topic in a special light. The National Association of State Development Agencies provided a mailing list of the "research directors" in each of its member states. A sample group of ten states (Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, New Jersey, New York, South Carolina, and Wyoming) was selected and the research director interviewed by telephone. The interview schedule is displayed in Appendix C. Many directors sent copies of recent studies or documents dealing with one aspect or another of research.

It is, perhaps, most convenient to start with the conclusion then present the details. No state has put together the four main features of The Pennsylvania Research Inventory Project; a flexible on-line data system, that covers academic and corporate units, includes multiple classifications, and lists special facilities, equipment, and associations. This unqiue advanced position for Pennsylvania does not suggest that there is any absence of very good work going on elsewhere. The principal features are worth noting. New York has developed the most comprehensive approach based on a commissioned study prepared by The Battelle Corporation. One part of that plan will involved a summary of research capability. The University of Illinois is developing an inventory of academic researchers at the major institutions. The data file, very detailed, will be entered on the SPIRES system and carries the label "FRATS". It will be available to inquiry from business but contains no industrial research information. South Carolina has included specialized research units in the industrial directory with a limited but very useful combination of information; four-digit SIC code.

Indiana maintains a list of research performers in industry giving the type of research and the number of employees in the data set. Several other states try to maintain what amounts to a mailing list of specialized researchers: West Virginia and Maryland are two. West Virginia University produces a list of academic researchers annually. In other states background studies are either underway or completed to assess historical precedents or contemporary conditions; New Jersey, Louisiana, and Arizona. Some of these documents are noted in the bibliography.

Much of the contemporary emphasis is going into exploratory studies seeking ways of combining the academic research into joint ventures with business. It is worth noting that The Pennsylvania Inventory can be the

natural instrument to sustain such collaboration without requiring any new or specialized programs. Given wide dissemination and open access, the Inventory will provide a vehicle for interaction among researchers and users on the terms most advantageous to both.

Among the regional studies, the comprehensive study by the Southern Regional Education Board (Bramlett 1974) is a landmark. The Western Interstate Commission for Higher Education (WICHE) produced two conference reports in 1981 and continues to coordinate exchanges among the member states. Arizona conducted a study of working relationships between postsecondary education and business that are coordinated on a statewide basis. A total of eighteen states came under review but very little other than programs for job training, often under CETA, and always at a modest skill level, turned up. This study was made in 1981.

In summary, quite a few states share an interest and an intention to act on the involvement of research activity as a resource in the process of economic development. None has yet produced an instrument as flexible as this Inventory to encourage interrelationships. Several are very close to the same kind of study. Others are following a track that leads to special labeled programs to link the research resources with production.

G. The Uses and Users of the Inventory

A distinction that has special significance for this project is often made when the "information revolution" is under discussion. The point is made that real property derives and improves its value through scarcity and rarity. Information products, whether computer software or working knowledge, attain their worth from wide circulation and extended usage. This Inventory is an information product and will be something more than a well-crafted curiosity only when it is familiar information throughout the business community.

An early step on the part of the Department of Commerce must be a well-targeted action to present the essential and rather simple components of the Inventory to bodies of potential users. Business and industrial associations, financial groups, county, borough, and city representatives, regional councils, community associations, service clubs, and analysts of economic and public policy; all are potential users. For any of those

constituencies, it is possible to see several different kinds of potential applications.

On the basis of expressions of interest that came forward as the Project was developing, the following people can probably turn the Inventory to advantage:

- small business operators
- industrial managers and executives
- new business initiators
- corporate research officers
- marketing specialists and survey companies
- local civil officials
- legislative staff members
- economic planners at various levels
- investigative commissions and committees
- regional and community councils
- promotion and development agencies at county and state levels
- academic researchers and analysts
- financial analysts and companies

The-Pennsylvania-Research-Inventory is essentially a reference file that can be used in simple direct ways but also as an indirect support for policy formation. Used directly the Inventory can:

- generate specialized mailing lists
- locate specialized research activities
- identify the sites of equipment and facilities
- summarize regional patterns of research
- specify individuals with particular competency
- give a current picture of who is doing what in various research areas
- provide a basic cross reference between academic and industrial research

As an instrument to support other objectives the inventory can:

- aid promotional efforts by giving regional profiles of research
- help with "trouble shooting" by pointing companies toward new resources
- give communities and regions a picture of existing strengths weaknesses
- aid in exploration of possibilities for relocation and expansion by industries
- offer a means to supplement company resources by affiliation with specialized research units
- on a statewide basis, aid planning for coordinated development patterns

The presentation of this final report is the beginning rather than the end of a project to develop a new information tool. It is a base of great flexibility and easy access. To those who ask "What use is it?" we borrow Ben Franklin's rejoinder to a similar question, "Of what use is a baby?"

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APPENDIX

APPENDIX A

This is a basic users' guide for the Pennsylvania Research Inventory Project (PRIP) data base. The data for PRIP is maintained in a SPIRES subfile called PRIP. The subfile consists of records incorporating both the academic as well as the industrial sectors in the Commonwealth of Pennsylvania. The Stanford Public Information Retrieval System (SPIRES) is copyrighted by the Board of Trustees of the Leland Stanford Junior University, 1982, with all rights reserved.

It is strongly recommended that before this subfile is accessed that the user be familiar with two SPIRES manuals. The first being A Guide to Data Base Development - A SPIRES Primer and the second being the SPIRES manual, Searching and Updating.

The File Definition

The SPIRES file definition for the PRIP subfile looks like this:

```
FILE B2S:SFS1 101 PRIP/AUTHOR ROBERT WILKINSON
SUBFILE PRIP/ACCOUNTS B2S, W49,
CMD  EXPLAIN SF PRIP
CMD  SHOW SUBFILE SIZE
CMD  *  PLEASE WAIT WHILE A FORMAT IS SET FOR YOU
CMD  SET FORMAT $PROMPT
CMD  *  THE $PROMPT FORMAT IS NOW SET
EXPLAIN   THIS IS A DATA BASE FILE FOR THE PENNSYLVANIA
EXPLAIN   RESEARCH INVENTORY PROJECT.  IT IS A CATALOG
EXPLAIN   OF THE RESEARCH CAPABILITIES IN THE COMMONWEALTH
EXPLAIN   OF PENNSYLVANIA.  IT INCLUDES INFORMATION ABOUT
EXPLAIN   BOTH THE EDUCATIONAL AND INDUSTRIAL COMMUNITIES IN PENNSYLVANIA
GOAL/RESULT    RESEARCH-UNIT
KEY  ID/SLOT
```

```
REQUIRED
ELEMENT   ADDED/DATE ADD
EXPLAIN   THIS ELEMENT GIVES THE DATA THE RECORD WAS ENTERED INTO
EXPLAIN   THE FILE
ELEMENT   UPDATED/DATE UPDATE/INDEX
EXPLAIN   THIS ELEMENT IS THE DATE THE RECORD WAS LAST UPDATED
ELEMENT   UNIT/TEXT/SINGLE/SQUEEZE/INDEX
EXPLAIN   THIS IS THE TITLE OF THE RESEARCH UNIT
EXPLAIN   OR THE COMPANY DEPARTMENT
ELEMENT   DIRECTOR,DR,D/NAME/SINGLE/INDEX
EXPLAIN   THIS IS THE NAME OF THE UNITS DIRECTOR
ELEMENT   INSTITUTION, COMPANY,CO/TEXT/SINGLE/SQUEEZE/INDEX
EXPLAIN   THIS ELEMENT REFERS TO THE NAME OF THE ACADEMIC
EXPLAIN   INSTITUTION OR THE NAME OF THE COMPANY
ELEMENT   ADDRESS/TEXT/SQUEEZE/SINGLE
ELEMENT   CITY-STATE/TEXT/SQUEEZE/SINGLE/INDEX
ELEMENT   ZIPCODE,ZIP/TEXT/SINGLE/SQUEEZE/INDEX
ELEMENT   COUNTY/TEXT/SINGLE/SQUEEZE/INDEX
INPROC    $DEFAULT
ELEMENT   REGION/TEXT/SINGLE/SQUEEZE/INDEX
INPROC    $DEFAULT
EXPLAIN   THESE ARE THE ECONOMIC DEVELOPMENT REGIONS AS
EXPLAIN   DEFINED BY THE PA. DEPARTMENT OF COMMERCE
ELEMENT   TELEPHONE, TELE,PHONE/TEXT/SQUEEZE/SINGLE
ELEMENT   N.C.E.S.,NCES/DECIMAL2.6/OCCURRENCE #/INDEX
EXPLAIN   THIS ELEMENT REFERES TO THE NATIONA CENTER
EXPLAIN   FOR EDUCATIONAL STATISTICS ACADEMIC PROGRAM
EXPLAIN   CODES AS SELECTED BY THE RESPONDENTS
ELEMENT   S.I.C.,SIC,S/TEXT/OCCURRENCE 3/INDEX/SQUEEZE
EXPLAIN   THIS ELEMENT REFERS TO THE STANDARD INDUSTRIAL
EXPLAIN   CODES AS SELECTED BY THE RESPONDENTS
ELEMENT   KEYWORD,KEY,WORD/TEXT/OCCURRENCE 3/SQUEEZE/INDEX
EXPLAIN   THIS ELEMENT REFERS TO THOSE KEY WORDS, CHOSEN
EXPLAIN   BY THE RESPONDENTS TO BEST DESCRIBE THE
EXPLAIN   PRODUCTS OF THE ACTIVITY
OPTIONAL
```

```
ELEMENT PERSONNEL,PERS/STRUCTURE
     ELEMENT   RESEARCH-PROS,RESEARCH,RPS/INTEGER/SINGLE
     ELEMENT   SUPPORT-PROS,SPS/INTEGER/SINGLE
     ELEMENT   TECHNICAL-STAFF,TECHNICAL,TECH,TS/INTEGER/SINGLE
     EXPLAIN   THIS ELEMENT REFERS TO LAB ASSISTANTS, GRADUATE
     EXPLAIN   ASSISTANTS, AND TECHNICIANS
     ELEMENT   SUPPORT-STAFF,SUPPORT,SS/INTEGER/SINGLE
     EXPLAIN   THIS ELEMENT REFERS TO SECRETARIES,ADMINISTRATORS,
     EXPLAIN   AND OTHER SUPPORTING PERSONNEL
     END
ELEMENT   CURRENT-FUNDING,CF/STRUCTURE
     ELEMENT   AMOUNT/DOLLAR REAL/SINGLE
          INPROC    $DOLLAR(REAL)
          OUTPROC   $DOLLAR.OUT(REAL)
     ELEMENT   SOURCE/TEXT/INDEX/WORD/EXCLUDE
     END
ELEMENT   PAST-FUNDING,PS/STRUCTURE
     ELEMENT   AMOUNT/DOLLAR REAL/SINGLE
          INPROC    $DOLLAR(REAL)
          OUTPROC   $DOLLAR.OUT(REAL)
     ELEMENT   SOURCE/TEXT/INDEX/WORD/EXCLUDE
     END
ELEMENT   FACILITIES,EQUIPMENT,EQUIP/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   BUILDINGS/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   LIBRARIES,LIBRARY,LIB/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   COOPERATIVES, COOPS,COOP/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   OUTPUTS, PRODUCTS/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   PARTICIPATE/YESNO/INDEX/MSG ENTER EITHER YES OR NO
EXPLAIN   THIS ELEMENT REFERS TO A RESPONDENT'S DESIRF
EXPLAIN   TO PARTICIPATE IN PENNSYLVANIA'S ECONOMIC
EXPLAIN   DEVELOPMENT
ELEMENT   USER/TEXT/SQUEEZE
EXPLAIN   THIS IS THE NAME OF THE PERSON ENTERING
EXPPLAIN  OR CORRECTING AT THIS TIME
ELEMENT   TYPE /ENCODE COLLEGE,UNIVERSITY,COMPANY
EXPLAIN   THIS ELEMENT REFERES TO THE TYPE OF INSTITUTION
```

```
EXPLAIN   OR COMPANY THE ENTRY IS USE COLLEGE OR
EXPLAIN   UNIVERSITY OR COMPANY AS THE CORRECT ENTRY
```

For the purpose of discussion this is what the file definition looks like when the EXPLAIN statements are removed:

```
FILE B2S:SFS1 101 PRIP/AUTHOR ROBERT WILKINSON
SUBFILE RESEARCH/ACCOUNTS B2S, W49,
CMD  EXPLAIN SF RESEARCH
CMD  SHOW SUBFILE SIZE
CMD  *    PLEASE WAIT WHILE A FORMAT IS SET FOR YOU
CMD  SET FORMAT $PROMPT
CMD  *    THE $PROMPT FORMAT IS NOW SET
GOAL/RESULT    RESEARCH-UNIT
KEY  ID/SLOT
REQUIRED
ELEMENT   ADDED/DAE ADD
ELEMENT   UPDATE/DATE UPDATE/INDEX
ELEMENT   UNIT/TEXT/SINGLE/SQUEEZE/INDEX
ELEMENT   DIRECTOR,DR,D/NAME/SINGLE/INDEX
ELEMENT   INSTITUTION,COMPANY,CO/TEXT/SINGLE/SQUEEZE/INDEX
ELEMENT   ADDRESS/TEXT/SQUEEZE/SINGLE
ELEMENT   CITY-STATE/TEXT/SQUEEZE/SINGLE/INDEX
ELEMENT   ZIPCODE,ZIP/TEXT/SINGLE/SQUEEZE/INDEX
ELEMENT   COUNTY/TEXT/SINGLE/SQUEEZE/INDEX
INPROC    $DEFAULT
ELEMENT   REGION/TEXT/SINGLE/SQUEEZE/INDEX
INPROC    $DEFAULT
ELEMENT   TELEPHONE, TELE,PHONE/TEXT/SQUEEZE/SINGLE
ELEMENT   N.C.E.S.,NCES/DECIMAL2.6/OCCURRENCE 3/INDEX
ELEMENT   S.I.C.,SIC,S/TEXT/OCCURRENCE 3/INDEX/SQUEEZE
ELEMENT   KEYWORD,KEY,WORD/TEXT/OCCURRENCE 3/SQUEEZE/INDEX
OPTIONAL
ELEMENT PERSONNEL,PERS/STRUCTURE
     ELEMENT   RESEARCH-PROS,RESEARCH,RPS/INTEGER/SINGLE
     ELEMENT   SUPPORT-PROS,SPS/INTEGER/SINGLE
     ELEMENT   TECHNICAL-STAFF,TECHNICAL,TECH,TS/INTEGER/SINGLE
     ELEMENT   SUPPORT-STAFF,SUPPORT,SS/INTEGER/SINGLE
```

```
     END
ELEMENT   CURRENT-FUNDING,CF/STRUCTURE
     ELEMENT   AMOUNT/DOLLAR REAL/SINGLE
          INPROC    $DOLLAR(REAL)
          OUTPROC   $DOLLAR.OUT(REAL)
     ELEMENT   SOURCE/TEXT/INDEX/WORD/EXCLUDE
     END
ELEMENT   PAST-FUNDING,PS/STRUCTURE
     ELEMENT   AMOUNT/DOLLAR REAL/SINGLE
          INPROC    $DOLLAR(REAL)
          OUTPROC   $DOLLAR.OUT(REAL)
     ELEMENT   SOURCE/TEXT/INDEX/WORD/EXCLUDE
     END
ELEMENT   FACILITIES,EQUIPMENT,EQUIP/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   BUILDINGS/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   LIBRARIES,LIBRARY,LIB/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   COOPERATIVES, COOPS,COOP/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   OUTPUTS, PRODUCTS/TEXT/SINGLE/INDEX/WORD/EXCLUDE
ELEMENT   PARTICIPATE/YESNO/INDEX/MSG ENTER EITHER YES OR NO
ELEMENT   USER/TEXT/SQUEEZE
ELEMENT   TYPE/ENCODE COLLEGE,UNIVERSITY,COMPANY
```

The line KEY ID/SLOT means that SPIRES automatically assigns an identification value to each record as it is added. The next thirteen elements are required; that is, values have to be entered for each of these elements or the record will not be accepted. The rest of the elements are optional, meaning they do not have to be used in order for the record to be accepted.

The first two elements are added and updated. The "ADDED" element refers to the date the record was added and the "UPDATE" element refers to the date its record was last updated. Do not try to correct either element just add the new date for the appropriate "UPDATE" prompt.

The next element is the name of the research unit. The data element is called UNIT; it is in the format text meaning words; it occurs once; all leading and trailing blanks are squeezed out; and the value is indexed meaning it is a searchable element.

The element DIRECTOR is the name of the director or head of the research unit. The element format is NAME meaning that the names are stored in the format LAST, FIRST, MIDDLE, which is necessary if the name is indexed. This element occurs once and is indexed.

The element INSTITUTION is the name of the academic institution or the name of the company. This element is in the TEXT format; it occurs once, leading and trailing blanks are squeezed out; and it is indexed.

The element KEYWORD is the keyword(s) selected by the research unit. The element is in the TEXT format, occurs three times and is indexed.

The element PERSONNEL is the number of personnel at the research unit. This element is a structure consisting of the four separate subelements RESEARCH-PROS, SUPPORT-PROS, TECHNICAL-STAFF, and SUPPORT-STAFF. Each of these subelements are in the INTEGER form and occur once.

The next two structured elements CURRENT-FUNDING and PAST-FUNDING refer to the funding for the current year and the funding for the previous year. Each element is a structure consisting of two subelements: the amount of funding and the source of the funding. The subelement AMOUNT which is in the format DOLLAR which means that SPIRES will ensure that its value is in the proper dollar and cents form. The subelement SOURCE is the source of the funding. This subelement is in the text format, and it is indexed by each word with all common articles and prepositions removed.

The element FACILITIES refers to the special facilities and or equipment reported. It is in the TEXT format and occurs once. The element is indexed by each word with the exclude option.

The next four elements, BUILDINGS, LIBRARIES, COOPERATIVES, and OUTPUTS are in the same format as FACILITIES.

The element PARTICIPATE refers to whether the research unit responded yes or no to the last question on the survey: Can your unit serve Pennsylvania's economic development program through contracted research, development, and consulting projects? This element is in the YESNO format which means, only the values Y, YE, YES, N, NO are allowed and the entry is stored as a one byte value. The element is also indexed.

The next element is "USER." It is in a text format and refers to the name of the person adding or updating a record.

The last element is "TYPE" and refers to which survey process was used to collect the data for the entry. The three choices are COLLEGE, UNIVERSITY, or COMPANY nothing else will be accepted. The element is encoded which means SPIRES stores the data or a one byte value.

Adding Records

The simplest way to add new records to the subfile is to use the SPIRES system format $PROMPT. This is a SPIRES format that prompts the user for the data. While this method is more expensive it is simpler and does not require indepth knowledge about the subfile elements.

In the example below, the left hand side are the SPIRES prompts and the responses on the right are typed by the user after which the RETURN key is pressed. If the data for any given element is larger than one line then use two slashes (//) at the end of each line and then press

RETURN. When the user does this SPIRES prompts for more (: more---).

The basic steps for the user to follow when adding data to the subfile RESEARCH are:

1. Enter SPIRES by typing: SPIRES
2. Type: SELECT PRIP
3. Type: SET FORMAT $PROMPT
4. Type: ADD.

SPIRES will then prompt the user for data. If more than one line needs to be entered for an element, type // before the 70th column. ENTER ALL NONNUMERIC DATA IN UPPER CASE ONLY. Do not enter more than 3 N.C.E.S. codes, 3 S.I.C. codes and 3 keywords (the system will prompt for a fourth so hit RETURN. If there are no N.C.E.S. codes enter 00.00 and hit RETURN, and when the second N.C.E.S. prompt shows hit RETURN, and the system will move to the next element. If there are no S.I.C. codes, use 99 and repeat the above. For funding use the prompts for current funding and ignore the prompt for past funding if no values are given. For the funding structure the system will prompt for source (1). Enter all sources at this time and ignore second prompt.

5. When a record has been completed SPIRES will respond with ADDED RECORD # (where # in the ID number assigned by SPIRES).
6. To add the next record. type: ADD. The system will prompt the user through the next record.

Here is an example of how to enter data using the $PROMPT format:

```
-SELECT PRIP
-SET FORMAT $PROMPT
-ADD
: ADDED (1) . . . . . 6/13/83---RETURN
```

```
: UPDATED (1) . . . . . .  6/13/83---RETURN
: UNIT                     SPROUL OBSERVATORY--RETURN to enter data
: DIRECTOR                 DR. JOHN E. GAUSTAD---Press RETURN
: INSTITUTION              SWATHMORE COLLEGE---Press RETURN
: ADDRESS                  SWARTHMORE COLLEGE---Press RETURN
: CITY-STATE               SWARTHMORE, PA---Press RETURN
: ZIPCODE                  19081---Press RETURN
: TELEPHONE                215-447-7271---Press RETURN
: N.C.E.S.(1)              40.02---Press RETURN
: N.C.E.S.(2)              ---Press RETURN to skip element
: S.I.C.(1)                99---PRESS RETURN
: S.I.C.(2)                ---Press RETURN to skip element
: KEYWORD(1)               ASTRONOMY OF NEARBY STARTS---Press RETURN
: KEYWORD(2)               PARALLAX---Press RETURN
: KEYOWRD(3)               STELLAR MASSES---Press RETURN
: KEYWORD(4)               ---PRESS RETURN to skip element

  STRUC:  PERSONNEL

: RESEARCH-PROS            3---Press RETURN
: SUPPORT-PROS             ---Press RETURN to skip element
: TECHNICAL-STAFF          3---Press RETURN
: SUPPORT-STAFF            1---Press RETURN

: RESEARCH-PROS            ---Press RETURN to leave structure

  Struc:  CURRENT-FUNDING

: AMOUNT                   76141---Press RETURN
: SOURCE(1)                NATIONAL SCIENCE FOUNDATION---Press RETURN
: SOURCE(2)                ---Press RETURN to skip element

: AMOUNT                   ---Press RETURN to leave structure

  STRUC:  PAST-FUNDING

: AMOUNT                   ---Press RETURN to skip element
```

```
: FACILITIES(1)          SPROUL 61 CM REFRACTOR---Press RETURN
: FACILITIES(2)          ---Press RETURN to skip element
: BUILDINGS(1)           SPROUL OBSERVATORY---Press RETURN
: BUILDINGS(2)           ---Press RETURN to skip element
: LIBRARIES(1)           SPROUL OBSERVATORY LIBRARY---Press RETURN
: LIBRARY(2)             ---Press RETURN to skip element
: COOPERATIVES(1)        ---Press RETURN to skip element
: OUTPUTS(1)             NUMEROUS RESEARCH REPORTS AND PAPERS---Press
                         RETURN
: OUTPUTS(2)             ---Press RETURN to skip element
: PARTICIPATE(1)         ---Press RETURN to skip element
-USER(1)                 A.L.V.---Press RETURN
-TYPE(1)                 COLLEGE---Press RETURN
-ADDED RECORD 939
```

Updating or Correcting

The simplest way to correct or update existing records is to use the SPIRES format $PROMPT. As in the adding of new records this method is a little more expensive but it is easier to use.

When using the MERGE command, for correcting, the $PROMPT format first displays the data for each element and then prompts for the corrected data. If no changes are needed for the element, press RETURN.

Here is a example of using the $PROMPT format for correcting a record.

```
-SELECT PRIP
-SET FORMAT $PROMPT
*MERGE 939
***939***
  ID . . . . . . . . . . . . 939
-ADDED(1) . . . . . . . . .  6/13/83---RETURN is pressed to accept
                             entry
```

```
-UPDATED(1) . . . . . 7/15/83---this date is entered as the
                      date that the corrections were made and
                      then RETURN is pressed.
  UNIT . . . . . SPROUL OBSERVATORY
: UNIT               RETURN is pressed to accept the entry
  DIRECTOR . . . . . GAUSTAD, DR. J.E.
: DIRECTOR           DR. JOHN E. GAUSTAD--Corrected data
                     entered and RETURN pressed
  INSTITUTION . . . . . SWARTHMORE COLLEGE
: INSTITUTION        ---RETURN pressed to accept the entry
  ADDRESS . . . . . DEPARTMENT
: ADDRESS            DEPARTMENT OF ASTRONOMY---corrected data
                     entered and RETURN pressed
: Do you wish to cancel this request? (YES/NO/HELP) NO
  CITY-STATE . . . . . SWARTHMORE, PA
: CITY-STATE         RETURN pressed to accept entry
  ZIPCODE            RETURN Pressed to accept entry
  TELEPHONE . . . . . 215-447-7271
: TELEPHONE          RETURN pressed to accept entry
  N.C.E.S.(1) . . . . . 40.020000
: N.C.E.S.(1)        RETURN pressed to accept entry
  S.I.C.(1) . . . . . 99
: S.I.C.(1)          RETURN pressed to accept entry
: S.I.C.(2)          RETURN pressed to accept entry
  KEYWORD(1) . . . . . ASTRONOMY OF NEARBY STARS
  KEYWORD(2) . . . . . PARALLAX
  KEYWORD(3) . . . . . STELLAR MASSES
: KEYWORD(1)         RETURN pressed to accept entry
: KEYWORD(2)         RETURN pressed to accept entry
: KEYWORD(3)         RETURN pressed to accept entry
: KEYWORD(4)         RETURN pressed to accept entry

  Struc: PERSONNEL
  RESEARCH-PROS . . . . 3
: RESEARCH-PROS      RETURN pressed to accept entry
: SUPPORT-PROS       RETURN pressed to accept entry
```

```
  TECHNICAL-STAFF  . . .   3
: TECHNICAL-STAFF          RETURN pressed to accept entry
  SUPPORT-STAFF  . . . .   1
: SUPPORT-STAFF            RETURN pressed to accept entry

: RESEARCH-PROS            RETURN pressed to accept entry

  Struc:  CURRENT-FUNDING

  AMOUNT  . . . . . .      $76141.00
: AMOUNT                   RETURN pressed to accept entry
  SOURCE(1) . . . . . .    NATIONAL SCIENCE FOUNDATION
: SOURCE(1)                RETURN pressed to accept entry
: SOURCE(2)                RETURN pressed to accept entry

: AMOUNT

  Struc:   PAST-FUNDING

: AMOUNT                   RETURN pressed to accept entry
  FACILITIES(1) . . . .    SPROUL 61 CM REFRACTOR, GRANT PLATE
                           MEASURING MACHING
: FACILITIES(1)            RETURN pressed to accept entry
: FACILITIES(2)            RETURN pressed to accept entry
  BUILDINGS(1) . . . .     SPROUL OBSERVATORY
: BUILDINGS(1) . . . .     RETURN pressed to accept entry
: BUILDINGS(2)             RETURN pressed to accept entry
  LIBRARIES (1) . . . .    SPROUL OBSERVATORY LIBRARY
: LIBRARIES(2)             RETURN pressed to accept entry
: COOPERATIVES(1)          RETURN pressed to skip entry
  OUTPUTS(1) . . . .       NUMEROUS RESEARCH REPORTS AND PAPERS
: OUTPUTS(1)               RETURN pressed to accept entry
: OUTPUTS(2)               RETURN pressed to accept entry
: PARTICIPATE(1)           RETURN pressed to skip entry
: USER(1) . . . . . .      A.L.V.---press RETURN to accept entry
```

```
: USER(2)                R.B.W.---Initials of Present User ---
                         press RETURN
: TYPE(1)                COLLEGE---press return to accept entry
```

There are also several subcommands that are useful in correcting and updating records.

-- "/R" to remove the data from the element.

-- "/E" to end prompting and process the record.

-- "/RS" to remove the data in an entire structure.

-- "/X" to abort the update or correcting process.

Displaying Records

To display a given record, use the DISPLAY command. This is the best way to see a record without conducting a search, but in order to use the command effectively and efficiently, it is best to know the ID number of the record you want to display. Here is an example of how the DISPLAY command works.

```
-SELECT PRIP
-DISPLAY 752
ID = 752
ADDED(1) = 6/15/83
UPDATED(1) = 7/15/83
UNIT = FRUIT RESEARCH LABORATORY
DIRECTOR = HICKEY, DR. K. D.
INSTITUTION = PENNSYLVANIA STATE UNIVERSITY
ADDRESS = N/A
CITY-STATE = BIGLERVILLE, PA
ZIPCODE = 17307
TELEPHONE = 717-677-6116
N.C.E.S. = 1.030400
N.C.E.S. = 2.040300
N.C.E.S. = 2.040600
S.I.C. = 17
```

S.I.C. = 287
KEYWORD = TREE FRUIT PRODUCTION
KEYWORD = PEST MANAGEMENT
PERSONNEL
RESEARCH-PROS = 4
SUPPORT-PROS = 2
TECHNICAL-STAFF = 8
SUPPORT-STAFF = 2
CURRENT-FUNDING
AMOUNT = $470,000.00
SOURCE = PENNSYLVANIA STATE UNIVERSITY COLLEGE OF AGRICULTURE CONSORTIUM FOR INTEGRATED POST MANAGEMENT, CHEMICAL COMPANIES, PENNSYLVANIA DEPARTMENT OF AGRICULTURE, PENNSYVLANIA HORTICULTURE ASSOCIATION, NE PESTICIDE IMPORT FUNDS, USDAARS
PAST-FUNDING
AMOUNT = $470,000.00
SOURCE = PENNSYLVANIA STATE UNIVERSITY COLLEGE OF AGRICULTURE, CONSORTIUM FOR INTEGRATED POST MANAGEMENT, CHEMICAL COMPANIES, PENNSYLVANIA DEPARTMENT OF AGRICULTURE, PENNSYVLANIA HORTICULTURE ASSOCIATION, NE PESTICIDE IMPORT FUNDS, USDAARS
FACILITIES = EQUIPMENT NECESSARY FOR ORCHARD CARE, SPECIALTY LABORATORIES IN VIROLOGY, NEMATOLOGY, ENTOMOLOGY, AND PLANT PATHOLOGY
BUILDINGS = SIX GREENHOUSE UNITS WITH HEADHOUSE MACHINE STORAGE
LIBRARIES = MAINTAINS A LIBRARY OR SEVERAL THOUSAND BOOKS, BULLETINS AND SEPARATES PRIMARILY ON FRUIT PROBLEMS
OUTPUTS = NUMEROUS RESEARCH PUBOISHED IN SCIENTIFIC JOURNALS AND GROWER PUBLICATIONS
PARTICIPATE = YES
USER(1) = A.L.V.
USER(2) = R.B.W.
TYPE(1) = UNIVERSITY

Searching

Before you can initiate a search of the subfile, you need to know what indexes to use. To find this out type the command SHOW INDEXES.

```
-SELECT PRIP
-SHOW INDEXES
Goal Records:  RESEARCH-UNIT
Simple Indes:  UPDATE
Simple Index:  UNIT
Simple Index:  D, DIRECTOR, DR
Simple Index:  CO, COMPANY, INSTITUTION
Simple Index:  CITY-STATE
Simple Index:  ZIP, ZIPCODE
Simple Index:  COUNTY
Smple Index:   REGION
Simple Index:  N.C.E.S., NCES
Simple Index:  S, S.I.C., SIC
Simple Index:  KEY, KEYWORD, WORD
Simple Index:  SOURCE
Simple Index:  SOURCE
Simple Index:  EQUIP, EQUIPMENT, FACILITIES
Simple Index:  BUILDINGS
Simple Index:  LIB, LIBRARIES, LIBRARY
Simple Index:  COOP, COOPERATIVES, COOPS
Simple Index:  OUTPUTS, PRODUCTS
Simple Index:  PARTICIPATE
```

This command will provide the user with the complete list of all available indexes and any abbreviations that are available. To find out the types of values that a given index contain, use the BROWSE command: BROWSE [INDEX-NAME].

```
-SELECT RESEARCH
-BROWSE KEYWORD
AIR POLLUTION
ELECTRICAL AND MECHANICAL ENGINEERING
INDUSTRIAL CERAMICS
NEW PRODUCTS
SOFTWARE APPLICATIONS
WATER SUPPLY NEEDS
WEAVING
WOOD PROCESSING
```

The BROWSE command will provide only a sample of the available values. The BROWSE command is a very powerful tool in the formualtion of search strategies. To obtain more information on the BROWSE command, type EXPLAIN BROWSE COMMAND and SPIRES will provide more detailed information about browsing indexes.

To conduct a search, first you select the subfile, then type the SEARCH command in the form: FIND [INDEX-NAME INDEXED VALUE]

```
-SELECT PRIP
-FIND KEYWORD AIR POLLUTION
RESULT:  2 RESEARCH-UNIT(S)
```

To view the result of the search type: TYPE. This command will cause SPIRES to display all records found in the search. If TYPE PAUSE is used, records will be displayed one at a time. Iterative searches can be conducted, using the words WITH, AND, NOT, and OR:

```
FIND KEYWORD WITH AIR
RESULT:  373 RESEARCH-UNIT(S)
    AND WITH POLLUTION
RESULT:   8 RESEARCH-UNIT(S)
```

There are also several arithmetic symbols that can be used in searching and can be used with any index.

(not equal to)

(greater than)

= (greater than or equal to)

(less than)

= (less than or equal to)

Output Formats

For this subfile there are two standard SPIRES output formats and five special output formats. The two standard formats are: 1) $PROMPT and 2) the standard default formate. The five special formats* are: 1) PHOTO, 2) SCRIPT, 3) DISPLAY, 4) ADDRESS, and 5) CARD.

The PHOTO format is the output format used to generate the report form for the book: List of Units and Indexes, this format inserts the appropriate script commands for the photo-composer used at The Pennsylvania State University Printing Service.**

The SCRIPT format is an output format that inserts normal SCRIPT commands for processing of SCRIPT on the computer. The DISPLAY format has the same form as the PHOTO and SCRIPT formats but no special commands are inserted. Instead, when the DISPLAY format is used with the SET REPORT command a print out of one unit per page is generated and with a header and page number.

---

* The format definitions and sample displays for each special format will be provided at the end of this section.

** For information on the Photo-composer call The Pennsylvania State University Printing Service.

The ADDRESS format is the format to be selected if mailing labels are to be generated. The CARD format organized the data in card images so statistical data can be generated. The output from CARD is organized as follows:

Card	Column	Element	
1	1-4	Record I D	
	5-9	Zip Code	
	10-22	County	
	24-42	Region Development Regions)	
	46-54	NCE (1)	0 or 00.00 or 00.000000 = default
	56-65	NCES (2)	0 or 00.00 or 00.000000 = default
	67-76	NCES (3)	0 or 00.00 or 00.000000 = default
2	1-3	SIC (1)	999 = default
	5-7	SIC (2)	999 = default
	9-11	SIC (3)	999 = default
	15-17	Research Prof.	0 or 0 = default
	19-21	Support Prof.	0 or 0 = default
	23-25	Technical Staff	0 or 0 = default
	27-29	Support Staff	0 or 0 = default
	31-43	Funding	Blank 0000.00 = default
	45-47	Participate	Yes No NOP - Not Answered
	48-50	Facilities	Yes No
	52-54	Buildings	Yes No
	56-58	Libraries	Yes No
	60-62	Cooperatives	Yes No
	64-66	Outputs	Yes No
	68-77	Type	College, University, Company

$PROMPT

This is what the output looks like when using the $$PROMPT format.

ID = 1

ADDED = 06/13/83

UPDATED = 7/15/83

UNIT = A.C. BALLAULN AND CO., INC.

DIRECTOR = BALLAULN, A. C.

INSTITUTION = A. C. BALLAULN AND CO., INC.

ADDRESS = 403 MORRIS LANE

CITY-STATE = WALLINGFORD, PA.

ZIPCODE = 19086

COUNTY

REGION

TELEPHONE = 215-872-2410

N.C.E.S. =

14.020000

S.I.C. = 372

KEYWORD = HELICOPTERS

KEYWORD = AIRCRAFT

PERSONNEL

RESEARCH-PROS = 1

SUPPORT-PROS = 1

SUPPORT-STAFF = 1

CURRENT-FUNDING

AMOUNT = $25,000.00

FACILITIES = ENGINEERING OFFICE

LIBRARIES = SMALL TECHNICAL LIBRARY

PARTICIPATE = Yes

USER (1) = ALV;

USER (2) = RBW;

TYPE = COMPANY;

PHOTO

This is what the output looks like when using the output format PHOTO.

.BD !1

.BI A.C. BALLAULN AND CO., INC.

A.C. BALLAULN, DIRECTOR

A.C. BALLAULN AND CO., INC.

403 MORRIS LANE

WALLINGFORD, PA 19086

DELAWARE COUNTY

DELAWARE VALLEY DEVELOPMENT REGION

PHONE: 215-872-2410

.BI N.C.E.S. CODES

14.020000

.BI S.I.C. CODES

372

KEYWORDS

HELICOPTERS

AIRCRAFT

PERSONNEL

1 RESEARCH PROFESSIONALS

1 SUPPORT PROFESSIONALS

0 TECHNICAL STAFF

1 SUPPORT STAFF

CURRENT FUNDING

AVERAGE AMOUNT = $25000.00

FACILITIES: ENGINEERING OFFICE

BUILDINGS: N/A

COLLECTIONS: SMALL TECHNICAL LIBRARY

COOPERATIVE ARRANGEMENTS: N/A

OUTPUTS: N/A

The SPIRES format definition for the output format PHOTO is as follows.

```
ID = B2S:PHOTO;
Author = RBW;
MODDATE = WED. JUNE 15, 1983;
DEFDATE = TUES, JAN. 11, 1983;
FILE = B2S:SFS1 101 PRIP;
RECORD-NAME = RECO1;
FRAME-ID = HEADER:
     DIRECTION = OUTPUT:
     FRAME-DIM = 3,50;
     USAGE = DISPLAY;
     LABEL;
```

```
            VALUE = 'PENNSYLVANIA RESEARCH INVENTORY PROJECT';
            START = 2,1;
            ADJUST = CENTER;
            PUTDATA;
        LABEL;
            VALUE = $STR($PAGENC);
            START = 1,1;
            INSERT = 'PAGE';
            ADJUST = RIGHT;
            PUTDATA;
FRAME-ID = RDUNIT:
        DIRECTION = OUTPUT;
        FRAME-DIM = 99,50;
        USAGE = DISPLAY:
        LABEL = ID;
            GETELEM;
            START = 3,1;
            INSERT = '.BD  ';
            PUTDATA;
        LABEL = INSTITUTION;
            GETELEM;
            START = 4,1;
            INSERT = '.BI ';
            PUTDATA:
        LABEL = DIRECTOR;
            GETELEM;
            START = X,1;
```

```
        OUTPROC = $NAME(FIRST.LAST);
        INSERT = EDN,', DIRECTOR';
        PUTDATA;
LABEL = UNIT;
        GETELEM;
        MARGINS = 1,50;
        START = X,1;
        PUTDATA;
LABEL = ADDRESS;
        GETELEM;
        START = X,1;
        PUTDATA;
LABEL = CITY-STATE;
        GETELEM;
        START = X,1;
        PUTDATA;
LABEL = ZIPCODE;
        GETELEM;
        START = *,*+2;
        PUTDATA;
LABEL = COUNTY;
        GETELEM;
        START = X,1;
        INSERT = END,' COUNTY';
        PUTDATA;
LABEL = REGION;
        GETELEM;
```

```
        START = X,1;
        INSERT = END,' DEVELOPMENT REGION';
        PUTDATA;
    LABEL = PHONE;
        GETELEM;
        START = X,1;
        INSERT = 'PHONE: ';
        PUTDATA;
    LABEL - N.C.E.S.;
        GETELEM;
        TITLE = '.BI N.C.E.S. CODES';
        TSTART = X+1,1;
        START = X,5;
        PUTDATA;
        LOOP;
    LABEL = S.I.C.;
        GETELEM;
        TITLE = '.BI S.I.C. CODES';
        TSTART = X,1;
        START = X,5;
        PUTDATA;
        LOOP;
    LABEL = KEYWORD;
        GETELEM;
        TITLE - 'KEYWORDS';
        TSTART - X,1;
        START - X,5;
```

```
        PUTDATA;
        LOOP;
LABEL = PERSONNEL;
        IND-STRUCTURE = PERSONNEL;
        IND-FRAME = PERSONNEL;
        TITLE = 'PERSONNEL';
        TSTART = X,1;
LABEL = CURRENT-FUNDING;
        IND-STRUCTURE = CURRENT-FUNDING;
        IND-FRAME = CURRENT-FUNDING;
        TITLE = 'CURRENT FUNDING';
        TSTART = X,1;
LABEL = PAST-FUNDING;
        IND-STRUCTURE = PAST-FUNDING;
        IND-FRAME = PAST-FUNDING;
        TITLE = 'PAST FUNDING';
        TSTART = X,1;
LABEL = FACILITIES;
        GETELEM:
        MARGINS = 1,50;
        START = X+1,1;
        INSERT = 'FACILITIES:  ';
        PUTDATA;
LABEL = BUILDINGS;
        GETELEM;
        DEFAULT = 'N/A';
        MARGINS = 1,50;
```

```
        START = X+1,1;
        INSERT = 'BUILDINGS:  ';
        PUTDATA;
    LABEL = LIBRARY;
        GETELEM;
        DEFAULT = 'N/A';
        MARGINS = 1,50;
        START = X+1,1;
        INSERT = 'COLLECTIONS:  ';
        PUTDATA;
    LABEL = COOPERATIVES;
        GETELEM;
        DEFAULT = 'N/A';
        MARGINS = 1,50;
        START = X+',1;
        INSERT = 'COOPERATIVE ARRANGEMENTS:  ';
        PUTDATA;
    LABEL = OUTPUTS;
        GETELEM;
        DEFAULT = 'N/A';
        MARGINS = 1,50;
        START = X+1,1;
        INSERT = 'OUTPUTS:  ';
        PUTDATA;
    LABEL;
        VALUE = '.SP';
        START = X,1;
```

```
          PUTDATA;
FRAME-ID = PERSONNEL;
     DIRECTION = OUTPUT;
     SUBTREE = PERSONNEL;
     USAGE = DISPLAY;
     LABEL = RESEARCH-PROS;
          GETELEM;
          DEFAULT = '0';
          START = X,5;
          INSERT = END,'  RESEARCH PROFESSIONALS';
          PUTDATA;
     LABEL = SUPPORT-PROS;
          GETELEM;
          DEFAULT = '0';
          START = X,5;
          INSERT = END,' RESEARCH PROFESSIONALS';
          PUTDATA;
     LABEL = SUPPORT-PROS;
          GETELEM;
          DEFAULT = '0';
          START = X,5;
          INSERT = END,'  SUPPORT PROFESSIONALS';
          PUTDATA;
     LABEL = TECHNICAL-STAFF;
          GETELEM;
          DEFAULT = '0';
          START =x,5;
```

```
            INSERT = END,' TECHNICAL STAFF';
            PUTDATA;
        LABEL = SUPPORT-STAFF;
            GETELEM;
            DEFAULT = '0';
            START = X,5;
            INSERT = END,  SUPPORT STAFF';
            PUTDATA;
    FRAME-ID = CURRENT-FUNDING;
        DIRECTION = OUTPUT;
        SUBTREE = CURRENT-FUNDING;
        USAGE = DISPLAY;
        LABEL = AMOUNT;
            GETELEM;
            START = X,5;
            INSERT = 'AVERAGE AMOUNT = ';
            PUTDATA;
        LABEL = SOURCE;
            GETELEM;
            MARGINS = 11,50;
            START = X,5;
            INSERT = 'SOURCES:  ';
            PUTDATA;
    FRAME-ID = PAST-FUNDING;
        DIRECTION = OUTPUT;
        SUBTREE = PAST-FUNDING;
        USAGE = DISPLAY;
```

```
     LABEL = AMOUNT;
          GETELEM;
          START = X,5;
          INSERT = 'AVERAGE AMOUNT = ';
          PUTDATA;
     LABEL = SOURCE;
          GETELEM;
          MARGINS = 11,50;
          START = X,5;
          INSERT = 'SOURCES:  ';
          PUTDATA;
FORMAT-ID = PHOTO;
     FRAME = HEADER;
          FRAME-TYPE = HEADER;
          UPROC = SET NEWPAGE;
     FRAME = PERSONNEL;
          FRAME-TYPE = INDIRECT;
     FRAME = CURRENT-FUNDING;
          FRAME-TYPE = INDIRECT;
     FRAME = PAST-FUNDING;
          FRAME-type = INDIRECT;
     FRAME = RDUNIT;
          FRAME-TYPE = DATA;
```

SCRIPT

The output generated by the SCRIPT format looks like this. The SCRIPT commands are inserted and the output is ready to be run as a SCRIPT program for further formating.

1

.BD A.C. BALLAULN AND CO., INC.

A.C. BALLAULN, DIRECTOR

A.C. BALLAULN AND CO., INC.

403 MORRIS LANE

WALLINGFORD, PA 19086

PHONE: 215872-2410

.BD N.C.E.S. CODES

14.020000

.BD S.I.C. CODES

372

.BD KEYWORDS

HELICOPTERS

AIRCRAFT

.BD PERSONNEL

1 RESEARCH PROFESSIONALS

1 SUPPORT PROFESSIONALS

0 TECHNICAL STAFF

1 SUPPORT STAFF

.BD CURRENT FUNDING

AVERAGE AMOUNT = $25000.00

FACILITIES: ENGINEERING OFFICE

BUILDINGS: N/A

COLLECTIONS: SMALL TECHNICAL LIBRARY

```
 COOPERATIVE ARRANGEMENTS:  N/A
 OUTPUTS:  N/A
WILL PARTICIPATE IN PA.  ECONOMIC DEVELOPMENT:  Yes
.CB
```

The output format definition for the SCRIPT format is this.

```
ID = B2S:SCRIPT;
Author = RBW;
MODDATE = WED. JUNE 15, 1983;
DEFDATE = TUES, JAN. 11, 1983;
FILE = B2S:SFS1 101 PRIP;
RECORD-NAME = RECO1;
FRAME-ID = HEADER:
     DIRECTION = OUTPUT:
     FRAME-DIM = 3,60;
     USAGE = DISPLAY;
     LABEL;
          VALUE = 'PENNSYLVANIA RESEARCH INVENTORY PROJECT';
          START = 2,1;
          ADJUST = CENTER';
          PUTDATA;
     LABEL;
          VALUE = $STR($PAGENC);
          START = 1,1;
          INSERT = 'PAGE';
```

```
            ADJUST = RIGHT;
            PUTDATA;
FRAME-ID = RDUNIT:
      DIRECTION = OUTPUT;
      FRAME-DIM = 99,66;
      USAGE = DISPLAY;
      LABEL = ID;
            GETELEM;
            START = 3,1;
            INSERT = '.BD  ';
            PUTDATA;
      LABEL = UNIT;
            GETELEM:
            START = 4,1;
            MARGINS = 1,60;
            PUTDATA;
      LABEL = DIRECTOR;
            GETELEM;
            START = X,1;
            OUTPROC = $NAME(FIRST.LAST);
            INSERT = END,', DIRECTOR';
            PUTDATA;
      LABEL = INSTITUTION;
            GETELEM;
            START - X,1;
            INSERT = '.BD ';
            PUTDATA;
```

```
LABEL = ADDRESS;
     GETELEM;
     START = X,1;
     PUTDATA;
LABEL = CITY-STATE;
     GETELEM;
     START = X,1;
     PUTDATA;
LABEL = ZIPCODE;
     GETELEM;
     START = *,*+2;
     PUTDATA;
LABEL = COUNTY;
     GETELEM;
     START = X,1;
     INSERT = END,' COUNTY';
     PUTDATA;
LABEL = REGION;
     GETELEM;
     START = X,1;
     INSERT = END,' DEVELOPMENT REGION';
     PUTDATA;
LABEL = PHONE;
     GETELEM;
     START = X,1;
     INSERT = 'PHONE: ';
     PUTDATA;
```

```
LABEL = N.C.E.S.;
     GETELEM;
     TITLE = '.BD N.C.E.S. CODES';
     TSTART = X+1,1;
     START = X,5;
     PUTDATA;
     LOOP;
LABEL = S.I.C.;
     GETELEM;
     TITLE = '.BD S.I.C. CODES';
     TSTART = X,1;
     START = X,5;
     PUTDATA;
     LOOP;
LABEL = KEYWORD;
     GETELEM;
     TITLE = 'KEYWORDS';
     TSTART = X,1;
     START = X,5;
     PUTDATA;
     LOOP;
LABEL = PERSONNEL;
     IND-STRUCTURE = PERSONNEL;
     IND-FRAME = PERSONNEL;
     TITLE = 'PERSONNEL';
     TSTART = X,1;
```

```
LABEL = CURRENT-FUNDING;
     IND-STRUCTURE = CURRENT-FUNDING;
     IND-FRAME = CURRENT-FUNDING:
     TITLE = 'CURRENT FUNDING';
     TSTART = X,1;
LABEL = PAST-FUNDING;
     IND-STRUCTURE = PAST-FUNDING;
     IND-FRAME = PAST-FUNDING;
     TITLE = 'PAST FUNDING';
     TSTART = X,1;
LABEL = FACILITIES;
     GETELEM:
     MARGINS = 1,60;
     START = X+1,1;
     INSERT = 'FACILITIES:  ';
     PUTDATA;
LABEL = BUILDINGS;
     GETELEM;
     DEFAULT = 'N/A';
     MARGINS = 1,60;
     START = X+1,1;
     INSERT = 'BUILDINGS:  ';
     PUTDATA;
LABEL = LIBRARY;
     GETELEM;
     DEFAULT = 'N/A';
     MARGINS = 1,60;
```

```
            START = X+1,1;
            INSERT = 'COLLECTIONS:  ';
            PUTDATA;
        LABEL = COOPERATIVES;
            GETELEM;
            DEFAULT = 'N/A';
            MARGINS = 1,60;
            START = X+1,1;
            INSERT = 'COOPERATIVE ARRANGEMENTS:  ';
            PUTDATA;
        LABEL = OUTPUTS;
            GETELEM;
            DEFAULT = 'N/A';
            MARGINS = 1,60;
            START = X+1,1;
            INSERT = 'OUTPUTS:  ';
            PUTDATA;
        LABEL;
            VALUE = '.CB';
            START = X,1;
            PUTDATA;
FRAME-ID = PERSONNEL;
    DIRECTION = OUTPUT;
    SUBTREE = PERSONNEL;
    USAGE = DISPLAY;
    LABEL = RESEARCH-PROS;
        GETELEM;
```

```
      DEFAULT = '0';
      START = X,5;
      INSERT = END,'  RESEARCH PROFESSIONALS';
      PUTDATA;
LABEL = SUPPORT-PROS;
      GETELEM;
      DEFAULT = '0';
      START = X,5;
      INSERT = END,' RESEARCH PROFESSIONALS';
      PUTDATA;
LABEL = SUPPORT-PROS;
      GETELEM;
      DEFAULT = '0';
      START = X,5;
      INSERT = END,'  SUPPORT PROFESSIONALS';
      PUTDATA;
LABEL = TECHNICAL-STAFF;
      GETELEM;
      DEFAULT = '0';
      START = x,5;
      INSERT = END,' TECHNICAL STAFF';
      PUTDATA;
LABEL = SUPPORT-STAFF;
      GETELEM;
      DEFAULT = '0';
      START = X,5;
      INSERT = END,  SUPPORT STAFF';
      PUTDATA;
```

```
FRAME-ID = CURRENT-FUNDING;
     DIRECTION = OUTPUT;
     SUBTREE = CURRENT-FUNDING;
     USAGE = DISPLAY;
     LABEL = AMOUNT;
          GETELEM;
          START = X,5;
          INSERT = 'AVERAGE AMOUNT ';
          PUTDATA;
     LABEL = SOURCE;
          GETELEM;
          MARGINS 11,60;
          START = X,5;
          INSERT = 'SOURCES:  ';
          PUTDATA;
FRAME-ID = PAST-FUNDING;
     DIRECTION = OUTPUT;
     SUBTREE = PAST-FUNDING;
     USAGE = DISPLAY;
     LABEL = AMOUNT;
          GETELEM;
          START = X,5;
          INSERT = 'AVERAGE AMOUNT = ';
          PUTDATA;
     LABEL = SOURCE;
          GETELEM;
          MARGINS = 11,60;
```

```
          START = X,5;
          INSERT = 'SOURCES:  ';
          PUTDATA;
FORMAT-ID = SCRIPT;
     FRAME = HEADER;
          FRAME-TYPE = HEADER;
          UPROC = SET NEWPAGE;
     FRAME = PERSONNEL;
          FRAME-TYPE = INDIRECT;
     FRAME = CURRENT-FUNDING;
          FRAME-TYPE = INDIRECT;
     FRAME = PAST-FUNDING;
          FRAME-type = INDIRECT;
     FRAME = RDUNIT;
          FRAME-TYPE = DATA;
```

DISPLAY

This is what the output looks like when using the DISPLAY format.

```
1
A.C. BALLAULN AND COM., INC.
A.C. BALLAULN, DIRECTOR
A.C. BALLAULN AND CO., INC.
403 MORRIS LANE
WALLINGFORD, PA  19086
PHONE:  215-872-2410
```

N.C.E.S. CODES

14.020000

S.I.C. CODES

372

KEYWORDS

HELICOPTERS

AIRCRAFT

PERSONNEL

1 RESEARCH PROFESSIONALS

1 SUPPORT PROFESSIONALS

0 TECHNICAL STAFF

1 SUPPORT STAFF

CURRENT FUNDING

AVERAGE AMOUNT = $25000.00

FACILITIES: ENGINEERING OFFICE

BUILDINGS: N/A

COLLECTIONS: SMALL TECHNICAL LIBRARY

COOPERATIVE ARRANGEMENTS: N/A

OUTPUTS: N/A

WILL PARTICIPATE IN PA. ECONOMIC DEVELOPMENT: YES

The output file definition for this output is:

The SPIRES format definition for the output format DISPLAY is as follows.

```
ID = B2S:DISPLAY;
Author = RBW;
MODDATE = WED. JUNE 15, 1983;
DEFDATE = TUES, JAN. 11, 1983;
FILE = B2S:SFS1 101 PRIP;
RECORD-NAME = RECO1;
FRAME-ID = HEADER:
     DIRECTION = OUTPUT:
     FRAME-DIM = 3,50;
     USAGE = DISPLAY;
     LABEL;
          VALUE = 'PENNSYLVANIA RESEARCH INVENTORY PROJECT';
          START = 2,1;
          ADJUST = CENTER;
          PUTDATA;
     LABEL;
          VALUE = $STR($PAGENC);
          START = 1,1;
          INSERT = 'PAGE';
          ADJUST = RIGHT;
          PUTDATA;
FRAME-ID = RDUNIT;
     DIRECTION = OUTPUT;
     FRAME-DIM = 99,60;
     USAGE = DISPLAY;
     LABEL = ID;
```

```
        GETELEM;
        START = 3,1;
        PUTDATA;
    LABEL = UNIT;
        GETELEM;
        MARGINS = 1,60;
        START = 4,1;
        PUTDATA:
    LABEL = DIRECTOR;
        GETELEM;
        START = X,1;
        OUTPROC = $NAME(FIRST.LAST);
        INSERT = END,', DIRECTOR';
        PUTDATA:
    LABEL = INSTITUTION;
        GETELEM;
        START = ,1;
        PUTDATA;
    LABEL = ADDRESS;
        GETELEM;
        START = X,1;
        PUTDATA;
    LABEL = CITY-STATE;
        GETELEM;
        START = X,1;
        PUTDATA;
```

```
LABEL = ZIPCODE;
     GETELEM;
     START = *,*+2;
     PUTDATA;
LABEL = COUNTY;
     GETELEM;
     START = X,1;
     INSERT = END,' COUNTY';
     PUTDATA;
LABEL = REGION;
     GETELEM;
     START = X,1;
     INSERT = END,' DEVELOPMENT REGION';
     PUTDATA;
LABEL = PHONE;
     GETELEM;
     START = X,1;
     INSERT = 'PHONE: ';
     PUTDATA;
LABEL = N.C.E.S.;
     GETELEM;
     TITLE = 'N.C.E.S. CODES';
     TSTART = X+1,1;
     START = X,5;
     PUTDATA;
     LOOP;
```

```
LABEL = S.I.C.;
     GETELEM;
     TITLE = 'S.I.C. CODES';
     TSTART = X,1;
     START = X,5;
     PUTDATA;
     LOOP;
LABEL = KEYWORD;
     GETELEM;
     TITLE = 'KEYWORDS';
     TSTART = X,1;
     START = X,5;
     PUTDATA;
     LOOP;
LABEL = PERSONNEL;
     IND-STRUCTURE = PERSONNEL;
     IND-FRAME = PERSONNEL;
     TITLE = 'PERSONNEL';
     TSTART = X,1;
LABEL = CURRENT-FUNDING;
     IND-STRUCTURE = CURRENT-FUNDING;
     IND-FRAME = CURRENT-FUNDING:
     TITLE = 'CURRENT FUNDING';
     TSTART = X,1;
LABEL = PAST-FUNDING;
     IND-STRUCTURE = PAST-FUNDING;
     IND-FRAME = PAST-FUNDING;
```

```
        TITLE = 'PAST FUNDING';
        TSTART = X,1;
    LABEL = FACILITIES;
        GETELEM:
        MARGINS = 1,60;
        START = X+1,1;
        INSERT = 'FACILITIES:  ';
        PUTDATA;
    LABEL = BUILDINGS;
        GETELEM;
        DEFAULT = 'N/A';
        MARGINS = 1,60;
        START = X+1,1;
        INSERT = 'BUILDINGS:  ';
        PUTDATA;
    LABEL = LIBRARY;
        GETELEM;
        DEFAULT = 'N/A';
        MARGINS = 1,60;
        START = X+1,1;
        INSERT = 'COLLECTIONS:  ';
        PUTDATA;
    LABEL = COOPERATIVES;
        GETELEM;
        DEFAULT = 'N/A';
        MARGINS = 1,60;
        START = X+1,1;
```

```
            INSERT = 'COOPERATIVE ARRANGEMENTS:  ';
            PUTDATA;
        LABEL = OUTPUTS;
            GETELEM;
            DEFAULT = 'N/A';
            MARGINS = 1,50;
            START = X+1,1;
            INSERT = 'OUTPUTS:  ';
            PUTDATA;
FRAME-ID = PERSONNEL;
    DIRECTION = OUTPUT;
    SUBTREE = PERSONNEL;
    USAGE = DISPLAY;
    LABEL = RESEARCH-PROS;
        GETELEM;
        DEFAULT = '0';
        START = X,5;
        INSERT = END,'  RESEARCH PROFESSIONALS';
        PUTDATA;
    LABEL = SUPPORT-PROS;
        GETELEM;
        DEFAULT = '0';
        START = X,5;
        INSERT = END,' RESEARCH PROFESSIONALS';
        PUTDATA;
    LABEL = SUPPORT-PROS;
        GETELEM;
```

```
          DEFAULT = '0';
          START = X,5;
          INSERT = END,'  SUPPORT PROFESSIONALS';
          PUTDATA;
     LABEL = TECHNICAL-STAFF;
          GETELEM;
          DEFAULT = '0';
          START =x,5;
          INSERT = END,' TECHNICAL STAFF';
          PUTDATA;
     LABEL = SUPPORT-STAFF;
          GETELEM;
          DEFAULT = '0';
          START = X,5;
          INSERT = END,  SUPPORT STAFF';
          PUTDATA;
FRAME-ID = CURRENT-FUNDING;
     DIRECTION = OUTPUT;
     SUBTREE = CURRENT-FUNDING;
     USAGE = DISPLAY;
     LABEL = AMOUNT;
          GETELEM;
          START = X,5;
          INSERT = 'AVERAGE AMOUNT ';
          PUTDATA;
     LABEL = SOURCE;
```

```
            GETELEM;
            MARGINS = 11,60;
            START = X,5;
            INSERT = 'SOURCES:  ';
            PUTDATA;
FRAME-ID = PAST-FUNDING;
     DIRECTION = OUTPUT;
     SUBTREE = PAST-FUNDING;
     USAGE = DISPLAY;
     LABEL = AMOUNT;
            GETELEM;
            START = X,5;
            INSERT = 'AVERAGE AMOUNT = ';
            PUTDATA;
     LABEL = SOURCE;
            GETELEM;
            MARGINS = 11,60;
            START = X,5;
            INSERT = 'SOURCES:  ';
            PUTDATA;
FORMAT-ID = DISPLAY;
     FRAME = HEADER;
            FRAME-TYPE = HEADER;
            UPROC = SET NEWPAGE;
     FRAME = PERSONNEL;
            FRAME-TYPE = INDIRECT;
     FRAME = CURRENT-FUNDING;
```

```
          FRAME-TYPE = INDIRECT;
     FRAME = PAST-FUNDING;
          FRAME-type = INDIRECT;
     FRAME = RDUNIT;
          FRAME-TYPE = DATA;
```

ADDRESS

This is the output generated by the ADDRESS format.

```
1

A.C. BALLAULN
A.C. BALLAULN AND CO., INC.
A.C. BALLAULN AND CO., INCL
403 MORRIS LANE
WALLINGFORD, PA  19086
```

The format definition for this output is:

```
ID = B2S:ADDRESS;
AUTHOR = RBW;
MODDATE = WED. JULY 6, 1983;
DEFDATE = TUES. JAN. 11, 1983;
FILE = B2S:SFS1 101 PRIP
RECORD-NAME =REC01;
FRAME-ID = RDUNIT;
     DIRECTION = OUTPUT;
     FRAME-DIM = 99,50;
     USAGE = DISPLAY;
```

```
LABEL = ID;
     GETELEM;
     START = 5,1;
     PUTDATA;
LABEL = DIRECTOR;
     GETELEM;
     START = X,1;
     OUTPROC = $NAME(FIRST.LAST);
     PUTDATA;
LABEL = UNIT;
     GETELEM;
     MARGINS = 1,50;
     START = X,1;
     PUTDATA;
LABEL = INSTITUTION;
     GETELEM;
     START = X,1;
     PUTDATA;
LABEL = ADDRESS;
     GETELEM;
     START = X,1;
     PUTDATA;
LABEL = CITY-STATE;
     GETELEM;
     START = X,1;
     PUTDATA;
```

```
LABEL = ZIPCODE;
     GETELEM;
     START = *,*+2;
     PUTDATA;
FORMAT-ID = ADDRESS;
  FRAME RDUNIT;
     FRAME-TYPE  DATA;
```

CARD

This is the output generated by the output format CARD. When using this format the code sheet provids above will be most useful.

```
  119086   DELAWARE   DELAWARE  VALLEY   14.02000000 00.000000   00.000000
372   999   999     1   1  000   1     $25000.00   YesYES   NO   YES   NO   NO
```

The format definition for this output format is:

```
ID = B2S:CARD;
AUTHOR = RBW;
MODDATE = TUES. JULY 12, 1983;
DEFDATE = TUES. JAN. 11, 1983;
FILE = B2S:SFS1 101 PRIP;
RECORD-NAME = REC01;
FRAME-ID = RDUNIT;
     DIRECTION = OUTPUT;
     FRAME-DIM = 3,80;
     USAGE = DISPLAY;
```

```
LABEL = ID;
     GETELEM:
     START = 1,1;
     LENGTH = 4;
     ADJUST = RIGHT;
     PUTDATA;
LABEL = ZIPCODE;
     GETELEM;
     START = 1,5;
     PUTDATA;
LABEL = COUNTY;
     GETELEM;
     START = 1,10;
     LENGTH = 13;
     ADJUST = RIGHT;
     PUTDATA;
LABEL = REGION;
     GETELEM;
     START = 1,24;
     LENGTH = 19;
     ADJUST =RIGHT;
     PUTDATA;
LABEL = N.C.E.S.;
     GETELEM;
     DEFAULT = 00.000000;
     START = 1,46;
     LENGTH = 9;
```

```
        ADJUST RIGHT;
        PUTDATA;
        LOOP = 2;
        XSTART = *,*+2;
    LABEL = S.I.C.;
        GETELEM;
        DEFAULT = 999;
        START = 2,1;
        LENGTH = 3;
        ADJUST = RIGHT;
        PUTDATA;
        LOOP = 2;
        XSTART = *,*+2;
    LABEL = PERSONNEL;
        IND-STRUCTURE = PERSONNEL;
        IND-FRAME = PERSONNEL;
    LABEL = CURRENT-FUNDING;
        IND-STRUCTURE = CURRENT-FUNDING;
        IND-FRAME = CURRENT-FUNDING;
        DEFAULT '$00.00';
    LABEL = PARTICIPATE;
        GETELEM;
        DEFAULT = NOP;
        START = 2,45;
        LENGTH = 3;
        ADJUST = RIGHT;
        PUTDATA;
```

```
LABEL = EQUIPMENT;
     GETELEM;
     DEFAULT = NO;
     START = 2,48;
     LENGTH = 3;
     ADJUST = RIGHT;
     UPROC = IF   $SIZE($CVAL)   2 THEN SET CVAL = 'YES';
     PUTDATA;
LABEL = BUILDINGS;
     GETELEM;
     DEFAULT = NO;
     START = 2,52;
     LENGTH = 3;
     ADJUST = RIGHT;
     UPROC = IF $SIZE($CVAL)  2 THEN SET CVAL = 'YES';
     PUTDATA;
LABEL = LIBRARIES;
     GETELEM;
     DEFAULT = NO;
     START = 2,56;
     LENGTH = 3;
     ADJUST = RIGHT;
     UPROC = IF $SIZE($CVAL)  2 THEN SET CVAL = 'YES';
     PUTDATA;
LABEL = COOPERATIVES;
     GETELEM;
     DEFAULT = NO;
```

```
            START 2,60;
            LENGTH = 3;
            ADJUST = RIGHT;
            UPROC = IF $SIZE($CVAL)  2 THEN SET CVAL = 'YES';
            PUTDATA;
        LABEL = OUTPUTS;
            GETELEM;
            DEFAULT = NO;
            START = 2,64;
            LENGTH = 3;
            ADJUST = RIGHT;
            UPROC = IF $SIZE($CVAL)  2 THEN SET CVAL = 'YES';
            PUTDATA;
FRAME-ID = PERSONNEL;
        DIRECTION = OUTPUT;
            SUBTREE = PERSONNEL;
            USAGE = DISPLAY;
        LABEL = RESEARCH-PROS;
            GETELEM;
            DEFAULT = '000';
            START = 2,15;
            LENGTH = 3;
            ADJUST = RIGHT;
            PUTDATA;
        LABEL = SUPPORT-PROS;
            GETELEM;
            DEFAULT = '000';
```

```
            START = 2,19;
            LENGTH = 3;
            ADJUST = RIGHT;
            PUTDATA;
      LABEL = TECHNICAL-STAFF;
            GETELEM;
            DEFAULT = '000';
            START = 2,23;
            LENGTH = 3;
            ADJUST = RIGHT;
            PUTDATA;
      LABLE = SUPPORT-STAFF;
            GETELEM;
            DEFAULT = '000';
            START = 2,27;
            LENGTH =3;
            ADJUST = RIGHT;
            PUTDATA;
FRAME-ID = CURRENT-FUNDING;
      DIRECTION = OUTPUT;
      SUBTREE = CURRENTFUNDING;
      USAGE = DISPLAY;
      LABEL = AMOUNT;
            GETELEM;
            DEFAULT = '0000.00';
            START = 2,31;
            LENGTH = 13;
```

```
            ADJUST = RIGHT;
            PUTDATA;
FORMAT-ID = CARD;
  FRAME = PERSONNEL;
            FRAME-TYPE = INDIRECT'
  FRAM = CURRENT-FUNDING;
            FRAME-TYPE = INDIRECT;
  FRAME = RDUNIT;
            FRAME-TYPE = DATA;
```

PENNSYLVANIA RESEARCH INVENTORY PROJECT

CENTER FOR THE STUDY OF HIGHER EDUCATION
THE PENNSYLVANIA STATE UNIVERSITY
325 POND LABORATORY
UNIVERSITY PARK, PA 16802
(814) 865-6346

PENNSYLVANIA ASSOCIATION OF
COLLEGES AND UNIVERSITIES
800 NORTH THIRD STREET
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(717) 232-8639

APPENDIX B

PROJECT DESCRIPTION

The Pennsylvania Research Inventory Project is designed to identify and catalog research and development capabilities in the Commonwealth. Information about both academic and corporate research and development in disciplines and fields of production most closely related to economic development is being gathered. The inventory is intended as a basic recourse for exchange and cooperation among the varied organizations, large and small, corporate and non-profit, public and private, that share an interest in the future of the State.

The unit of study is the *coherent, organized, research effort*, that is to say, an organizational unit. We are designating organized and continuing endeavors rather than the single projects, scholarly inquiries, quality control, routine product testing, or casual personal explorations that sometimes have been gathered in the past. Such an organized effort will have a focus of interest and activities, specialized personnel at the professional and technical level, discrete funding or budgeted support, and, often, products or outputs of a distinctive kind. The area of activity will be described along one or more of these three dimensions; discipline code using a taxonomy NCES code that has recently been standardized across the federal system, industrial area using the familiar National Industrial Code, and product keywords provided by the respondent.

The specific outcome of this project will be a printed list with descriptors that will make the catalog a basic information source that can be updated as needed. It may be available also in a form, tape or disc, that can be accessed through a standard data processing terminal.

The sciences, certain technological areas, and selected specialities in business and management are likely to have importance in the near-term future, the next five to ten years, in Pennsylvania, and they are of primary concern. However, the collection process will necessarily be as broad as feasible because we cannot fix precisely those fields with the greatest potential for strengthening and attracting enterprises that advance the economy of the State and the lives of its citizens.

APPENDIX B Letter to College Presidents

PENNSYLVANIA RESEARCH INVENTORY PROJECT

CENTER FOR THE STUDY OF HIGHER EDUCATION
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800 NORTH THIRD STREET
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October, 1982

ADVISORY COMMITTEE

Dr. Thomas M. Cawthon
VP & Technical Director
Pennwalt Corporation

Dr. Herman E. Collier, Jr. (Chair)
President
Moravian College

Dr. Charles L. Duncan
Vice President, R&D
Hershey Foods Corp

Dr. Ulrich Merten
VP Chemicals & Minerals Div.
Gulf Science & Technology
Company

Mr. Harry L. Peters
VP Engineering
Fischer and Porter Co.

Dr. Walter Plosila
Dir., Governor's Office
of Policy & Planning

Hon. Geoffrey Stengel, Jr.
Secty., Dept. of Commerce

PRINCIPAL INVESTIGATORS

Dr. Kenneth P. Mortimer
Dr. William Toombs, Director
Center for the Study of
Higher Education

SPONSORED BY:

Penna Science and
Engineering Foundation
Applachian Regional
Commission

Dear Colleague:

In collaboration with PACU and support from The Pennsylvania Science and Engineering Foundation and the Appalachian Regional Commission we are gathering information about the resources for research in the Commonwealth. A description of the project is enclosed and you will see immediately its importance to institutions of higher education.

The final product will be an inventory of organized research efforts and we request your assistance in identifying research units on your campus. As we refine the information, it is likely that several exchanges with your institution will be necessary. Your endorsement is a prerequisite to accurate and complete information, but there may be another member of your staff who is particularly well acquainted with the details of research. If you wish to send us his/her name on the tear sheet, we will contact him/her rather than continuing to address your office.

To bring a measure of order to the inquiry, we have developed several working definitions: Our focus is on coherent, organized research efforts, that is to say, organizational entities, large or small, whose members work in a discrete area of a discipline or sub-discipline over an extended period of time. We are not simply cataloging current projects or one-time funding experiences, but are seeking to record sustained endeavors in selected areas of science and fields of practice. In colleges and universities these may take several common forms: (1) Discrete, semi-autonomous laboratories, centers, or institutes often exist; (2) In other cases concentrated departmental research in which several persons work in collaboration to illuminate a particular area of knowledge; (3) Finally, there may be a few individuals who pursue a particular topic over a long period of time in a coordinated way. Each of these activities fits our definition of a coherent, organized research effort.

At each of these levels, the effort may be strengthened by the presence of one or more of the following factors: the availability of special facilities, specialized equipment, or unusual assistance; a separate budget with funds from either internal or external sources; concentration of the investigators in a particular sub-specialty well-known to the field. By means of the attached form(s), we ask you to identify each effort and give some specific information that will help us construct an accurate description.

On the accompanying form(s) please record separately information for every organized research effort. If your institution does not have a coherent, organized research unit, please indicate this on the form. Return the completed forms in the postpaid envelope. As a start on this inquiry, we have gathered and noted public information, if any, on research funding at your institution. More forms are available if you need them.

If you have any questions, please call either of us, or Robert Wilkinson, at (814)865-6346.

Sincerely,

William Toombs
Kenneth P. Mortimer
Principal Investigators

Enclosures

Tear

For this institution please direct inquiries on research activity to:

Name _____

Title _____

Address _____

Telephone _____

APPENDIX B Follow-up Letter to the Colleges

PENNSYLVANIA RESEARCH INVENTORY PROJECT

CENTER FOR THE STUDY OF HIGHER EDUCATION
THE PENNSYLVANIA STATE UNIVERSITY
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UNIVERSITY PARK, PA 16802
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PENNSYLVANIA ASSOCIATION OF
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October 11, 1982

ADVISORY COMMITTEE

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VP & Technical Director
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Moravian College

Dr. Charles L. Duncan
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Hershey Foods Corp.

Dr. Ulrich Merten
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Mr. Harry L. Peters
VP Engineering
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Dr. Walter Plosila
Dir., Governor's Office of Policy & Planning

Hon. Geoffrey Stengel, Jr.
Secty., Dept. of Commerce

PRINCIPAL INVESTIGATORS

Dr. Kenneth P. Mortimer
Dr. William Toombs, Director
Center for the Study of Higher Education

SPONSORED BY:

Penna Science and Engineering Foundation
Applachian Regional Commission

Dear President:

Approximately two weeks ago we wrote to you about our Pennsylvania Research Inventory Project. As of today we have not received your response.

The number of questionnaires returned so far is very encouraging, but we need your information to describe fully the resources for research in the Commonwealth. Even if your institution has no research units, we would like to have the returned form. We would appreciate receipt of the questionnaire by October 18.

The beginning of the academic year may not be the easiest time to reach the person most able to respond and there is some risk of misdirection. If you did not receive the original material; if you mislaid the instrument; or if you have questions, please call either of us or Robert Wilkinson at (814)865-6346.

Sincerely,

William Toombs

William Toombs
Kenneth P. Mortimer
Principal Investigators

WT:mtd

PENNSYLVANIA RESEARCH INVENTORY PROJECT

CENTER FOR THE STUDY OF HIGHER EDUCATION
THE PENNSYLVANIA STATE UNIVERSITY
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PENNSYLVANIA ASSOCIATION OF
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800 NORTH THIRD STREET
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November 29, 1982

ADVISORY COMMITTEE

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Pennwalt Corporation

Dr. Herman E. Collier, Jr. (Chair)
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Moravian College

Dr. Charles L. Duncan
Vice President, R&D
Hershey Foods Corp.

Dr. Ulrich Merten
VP Chemicals & Minerals Div.
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Company

Mr. Harry L. Peters
VP Engineering
Fischer and Porter Co.

Dr. Walter Plosila
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Hon. Geoffrey Stengel, Jr.
Secty., Dept. of Commerce

PRINCIPAL INVESTIGATORS

Dr. Kenneth P. Mortimer
Dr. William Toombs, Director
Center for the Study of
Higher Education

SPONSORED BY:

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Engineering Foundation
Applachian Regional
Commission

Dear

From the Pennsylvania Association of Colleges and Universities or from public notices you may already be aware of this Project. A brief description of this effort to catalogue organized research activities in the academic and corporate sectors of the State is attached.

Very shortly we shall be in touch with your senior research officer about collecting information regarding your institution. By first going through federal documents and commercial listings we have tried to make the response from institutions as convenient as possible.

It is unlikely that this activity will require direct action by your office but I write to request your support and to tell you of the Project.

Sincerely,

William Toombs
Kenneth P. Mortimer
Principal Investigators

Enclosure
WT/KPM/pmd

APPENDIX B Letter to University Contact Person

PENNSYLVANIA RESEARCH INVENTORY PROJECT

CENTER FOR THE STUDY OF HIGHER EDUCATION
THE PENNSYLVANIA STATE UNIVERSITY
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PENNSYLVANIA ASSOCIATION OF
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January 17, 1983

ADVISORY COMMITTEE

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Vice President, R&D
Hershey Foods Corp.

Dr. Ulrich Merten
VP Chemicals & Minerals Div.
Gulf Science & Technology Company

Mr. Harry L. Peters
VP Engineering
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Dr. Walter Plosila
Dir., Governor's Office of Policy & Planning

Hon. Geoffrey Stengel, Jr.
Secty., Dept. of Commerce

PRINCIPAL INVESTIGATORS

Dr. Kenneth P. Mortimer
Dr. William Toombs, Director
Center for the Study of Higher Education

SPONSORED BY:

Penna Science and Engineering Foundation
Applachian Regional Commission

Dear

In collaboration with PACU and with support from both The Pennsylvania Science and Engineering Foundation and the Appalachian Regional Commission we are gathering information about the resources for research in the Commonwealth. A description of the project is enclosed and you will see immediately its importance to institutions of higher education, and to business as well. I write to request your assistance with the Project.

The final product will be a printed inventory of organized research units in Pennsylvania. The focus is on coherent, organized research efforts, that is to say, organizational entities, large or small, whose members work in a discrete area of a discipline or sub-discipline over an extended period of time. Of course this will include the formally established laboratories, centers, and institututes but we would also like to identify those long-continuing, well-focused research efforts that sometimes develop within departments. We are not simply cataloging projects or one-time funding experiences, but are seeking to record sustained endeavors in areas of science and fields of practice.

In summary, research in universities takes several common forms: (1) Discrete, semi-autonomous laboratories, centers, or institutes; (2) departmental research in which several persons concentrate on a particular area of knowledge; (3) Finally, there may be a few individuals who pursue a particular topic over a long period of time in a coordinated way. Each of these activities fits our definition of a coherent, organized research effort.

Enclosed are forms for each of your research centers. Please have the material corrected and amended then returned either via your office or directly to us. We have gone through

federal records and commercial listings in order to reduce the data items to a minimum and make the response as convenient as possible.

One of the major problems in a project of this nature is identifying new or emerging units and we need your direct help with this aspect of the study. We have enclosed several sets of materials to be used for any research centers that are not included in our survey.

If you have any questions, please call either of us, or Robert Wilkinson, at (814)865-6346.

Sincerely,

William Toombs
Kenneth P. Mortimer
Principal Investigators

WT:mtd
Enclosures

APPENDIX C-I Letter to Large Corporation

PENNSYLVANIA RESEARCH INVENTORY PROJECT

CENTER FOR THE STUDY OF HIGHER EDUCATION
THE PENNSYLVANIA STATE UNIVERSITY
325 POND LABORATORY
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(814) 865-6346

January 13, 1983

PENNSYLVANIA ASSOCIATION OF
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ADVISORY COMMITTEE

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Vice President, R&D
Hershey Foods Corp.

Dr. Ulrich Merten
VP Chemicals & Minerals Div.
Gulf Science & Technology Company

Mr. Harry L. Peters
VP Engineering
Fischer and Porter Co.

Dr. Walter Plosila
Dir., Governor's Office of Policy & Planning

Hon. Geoffrey Stengel, Jr.
Secty., Dept. of Commerce

PRINCIPAL INVESTIGATORS

Dr. Kenneth P. Mortimer
Dr. William Toombs, Director
Center for the Study of Higher Education

SPONSORED BY:

Penna Science and Engineering Foundation
Applachian Regional Commission

Chief Executive Officer

Dear Sir:

We have the responsibility for gathering information on research and development efforts throughout the Commonwealth of Pennsylvania, and your help is needed with one phase of the project. Comprehensive data on research and development have basic importance for any effort to chart a long-range economic development program in support of business, industry, and service enterprises in the state.

Most of the current listings understate the true extent of such efforts, particularly in the corporate sector. With your assistance we can improve this situation and create an accessible fund of information that will be useful to you and to other members of the business community.

Through an examination of published sources it is clear that your firm is likely to conduct research and development activities. The attached survey form(s) will record a set of characteristics for each organized research and development unit. We are requesting only the basic data and provide a return envelope for your convenience.

It may be that your company has a number of separate research units. If you would prefer that we contact each one separately, please send us a mailing list.

A brief description of the project is printed on the back of this letter and if you have any additional questions, please call us at 814-865-6346. Be assured that nothing in the survey materials will compromise the confidentiality of your business or technical procedures.

Sincerely,

William Toombs

William Toombs
Kenneth P. Mortimer
Principal Investigators

WT/KPM/pmd
Enclosures

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF COMMERCE
HARRISBURG

THE SECRETARY

Dear Pennsylvania Businessman:

I urge you to take a few minutes to respond to the enclosed survey questionaire. The information you provide will be included in a data bank now being compiled which will list private sector and academic research facilities, equipment and personnel within Pennsylvania. The survey is being conducted by the Pennsylvania State University and is funded by grants from the Pennsylvania Science and Engineering Foundation and the Bureau of Appalachian Development and State Grants.

In addition to being a very useful tool for planning at the state government level we have identified several potential benefits for Pennsylvania businesses participating in the survey. Some of these potential benefits are:

- Matching Pennsylvania suppliers to potential markets (including export markets) identified by the Department of Commerce
- Identification of training needs for state-sponsored customized training programs
- Matching the research capabilities of Pennsylvania companies to the needs of Federal Government departments under the new Small Business Innovation Research (SBIR) Program which sets aside portions of Federal research money for small businesses
- Identification of potential suppliers or customers for firms being recruited into Pennsylvania by the Department of Commerce

There are probably many more benefits to be derived from the inventory system once it is in place and operating. I hope you will decide to include the information from your firm in the research facilities inventory.

Sincerely,

James O. Pickard

James O. Pickard
Acting Secretary of Commerce

JOP:wjc

APPENDIX C-II Letter to Small Corporation

PENNSYLVANIA RESEARCH INVENTORY PROJECT

CENTER FOR THE STUDY OF HIGHER EDUCATION
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January 18, 1983

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VP & Technical Director
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Hershey Foods Corp

Dr. Ulrich Merten
VP Chemicals & Minerals Div.
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Company

Mr. Harry L. Peters
VP Engineering
Fischer and Porter Co.

Dr. Walter Plosila
Dir., Governor's Office
of Policy & Planning

Hon. Geoffrey Stengel, Jr.
Secty., Dept. of Commerce

PRINCIPAL INVESTIGATORS

Dr. Kenneth P. Mortimer
Dr. William Toombs, Director
Center for the Study of
Higher Education

SPONSORED BY:

Penna Science and
Engineering Foundation
Applachian Regional
Commission

Chief Executive Officer

Dear Sir:

We have the responsibility for gathering information on research and development efforts throughout the Commonwealth of Pennsylvania, and your help is needed with one aspect of the project. Comprehensive data on research and development have basic importance for any endeavor at charting a long-range economic development program in support of business, industry, and service enterprises in the state.

Most of the current listings of research and development activity understate the extent of the efforts, particularly in the corporate sector. With your assistance we can improve this situation and create an accessible fund of information that will be useful to you and to other members of the business community.

If your firm has a division, section, office, or laboratory whose major activity is research and development then we ask you to complete the attached survey form. The response form records a set of basic characteristics for each organizational unit within your company and photocopies of the form can be made if you need them.

If your firm has no research and development activity within the organizational structure then the materials can be discarded.

A brief description of the project is printed on the back of this letter and if you have any additional questions, please call us at 814-865-6346. The project has joint sponsorship from the Pennsylvania Science and Engineering Foundation and the Appalachian Regional Commission. Be assured that nothing in the survey materials will compromise the confidentiality of your business or technical procedures.

Sincerely,

William Toombs
Kenneth P. Mortimer
Principal Investigators

WT/KPM/pmd
Enclosures

STANDARD INDUSTRIAL CLASSIFICATION

01. Agricultural Production-Crops
- 011 Cash Grains
- 013 Field Crops, Except Cash Grains
- 016 Vegetables & Melons
- 017 Fruits & Tree Nuts
- 018 Horticultural Specialties
- 019 General Farms, Primarily Crop

02. Agricultural Production-Livestock
- 021 Livestock, Except Dairy, Poultry, & Animal Specialties
- 024 Dairy Farms
- 025 Poultry & Eggs
- 027 Animal Specialties
- 029 General Farms, Primarily Livestock

07. Agricultural Services
- 071 Soil Preparation Services
- 072 Crop Services
- 074 Veterinary Services
- 075 Animal Services, Except Veterinary
- 076 Farm Labor & Management Services
- 078 Landscape & Horticultural Services

08. Forestry
- 081 Timber Tracts
- 082 Forest Nurseries & Tree Seed Gathering & Extracting
- 084 Gathering of Miscellaneous Forest Products, Except Tree Seeds
- 085 Forestry Services

09. Fishing, Hunting, & Trapping
- 091 Commercial Fishing
- 092 Fish Hatcheries & Preserves
- 097 Hunting & Trapping, & Game Propagation

10. Metal Mining
- 101 Iron Ores
- 102 Copper Ores
- 103 Lead & Zinc Ores
- 104 Gold & Silver Ores
- 105 Bauxite & Other Aluminum Ores
- 106 Ferroalloy Ores, Except Vanadium
- 108 Metal Mining Services
- 109 Miscellaneous Metal Ores

11. Anthracite Mining

12. Bituminous Coal & Lignite Mining

13. Oil & Gas Extraction
- 131 Crude Petroleum & Natural Gas
- 132 Natural Gas Liquids
- 138 Oil & Glass Field Services

14. Mining & Quarrying of Nonmetallic Minerals, Except Fuels
- 141 Dimension Stone
- 142 Crushed & Broken Stone, Including Riprap
- 144 Sand & Gravel
- 145 Clay, Ceramic, & Refractory Minerals
- 147 Chemical & Fertilizer Mineral Mining
- 148 Nonmetallic Minerals (Except Fuels) Services
- 149 Miscellaneous Nonmetallic Minerals, Except Fuels

15. Building Construction-General Contractors & Operative Builders
- 152 General Building Contractors-Residential Buildings
- 153 Operative Builders
- 154 General Building Contractors-Nonresidential Buildings

16. Construction Other Than Building Construction -General Contractors
- 161 Highway & Street Construction, Except Elevated Highways
- 162 Heavy Construction, Except Highway & Street Construction

20. Food & Kindred Products
- 201 Meat Products
- 202 Dairy Products
- 203 Canned & Preserved Fruits & Vegetables
- 204 Grain Mill Products
- 205 Bakery Products
- 206 Sugar & Confectionery Products
- 207 Fats & Oils
- 208 Beverages
- 209 Miscellaneous Food Preparations & Kindred Products

21. Tobacco Manufactures
- 211 Cigarettes
- 212 Cigars
- 213 Tobacco (Chewing & Smoking) & Snuff
- 214 Tobacco Stemming & Redrying

22. Textile Mill Products
- 221 Broad Woven Fabric Mills, Cotton
- 222 Broad Woven Fabric Mills, Man-made Fiber & Silk
- 223 Broad Woven Fabric Millls, Wool (Including Dyeing & Finishing)
- 224 Narrow Fabrics & Other Smallwares Mills: Cotton, Wool, Silk, & Man-made Fiber
- 225 Knitting Mills
- 226 Dyeing & Finishing Textiles, Except Wool Fabrics & Knit Goods
- 227 Floor Covering Mills
- 228 Yarn & Thread Mills
- 229 Miscellaneous Textile Goods

24. Lumber & Wood Products, Except Furniture
- 241 Logging Camps & Logging Contractors
- 242 Sawmills & Planing Mills
- 243 Millwork, Veneer, Plywood, & Structural Wood Members
- 244 Wood Containers
- 245 Wood Buildings & Mobile Homes
- 249 Miscellaneous Wood Products

26. Paper & Allied Products
- 261 Pulp Mills
- 262 Paper Mills, Except Building Paper Mills
- 263 Paperboard Mills
- 264 Converted Paper & Paperboard Products, Except Containers & Boxes
- 265 Paperboard Containers & Boxes
- 266 Building Paper & Building Board Mills

27. Printing, Publishing, & Allied Industries
- 271 Newspapers: Publishing, Publishing & Printing
- 272 Periodicals: Publishing, Publishing & Printing
- 273 Books
- 274 Miscellaneous Publishing
- 275 Commercial Printing
- 276 Manifold Business Forms
- 277 Greeting Card Publishing
- 278 Blankbooks, Looseleaf Binders, & Bookbinding & Related Work
- 279 Service Industries for the Printing Trade

28. Chemicals & Allied Products
- 281 Industrial Inorganic Chemicals
- 282 Plastics Materials & Synthetic Resins, Synthetic Rubber, Synthetic & Other Man-Made Fibers, Except Glass
- 283 Drugs
- 284 Soap, Detergents, & Cleaning Preparations, Perfumes, Cosmetics, & Other Toilet Preparations
- 285 Paints, Varnishes, Lacquers, Enamels, & Allied Products
- 286 Industrial Organic Chemicals
- 287 Agricultural Chemicals
- 289 Miscellaneous Chemical Products

29. Petroleum Refining & Related Industries
- 291 Petroleum Refining
- 295 Paving & Roofing Materials
- 299 Miscellaneous Products of Petroleum & Coal

30. Rubber & Miscellaneous Plastics Products
- 301 Tires & Inner Tubes
- 302 Rubber & Plastics Footwear
- 303 Reclaimed Rubber
- 304 Rubber & Plastics Hose & Belting
- 306 Fabricated Rubber Products, Not Elsewhere Classified
- 307 Miscellaneous Plastics Products

32. Stone, Clay, Glass & Concrete Products
- 321 Flat Glass
- 322 Glass & Glassware, Pressed or Blown
- 323 Glass Products, Made of Purchased Glass
- 324 Cement, Hydraulic
- 325 Structural Clay Products
- 326 Pottery & Related Products
- 327 Concrete, Gypsum, & Plaster Products
- 328 Cut Stone & Stone Products
- 329 Abrasive, Asbestos, & Miscellaneous Nonmetallic Mineral Products

33. Primary Metal Industries
- 331 Blast Furnaces, Steel Works, & Rolling & Finishing Mills
- 332 Iron & Steel Foundries
- 333 Primary Smelting & Refining of Nonferrous Metals
- 334 Secondary Smelting & Refining of Nonferrous Metals
- 335 Rolling, Drawing, & Extruding of Nonferrous Metals
- 336 Nonferrous Foundries (Castings)
- 339 Miscellaneous Primary Metal Products

34. Fabricated Metal Products, Except Machinery & Transportation Equipment
- 341 Metal Cans & Shipping Containers
- 342 Cutlery, Hand Tools, & General Hardware
- 343 Heating Equipment, Except Electric & Warm Air; & Plumbing Fixtures
- 344 Fabricated Structural Metal Products
- 345 Screw Machine Products, & Bolts, Nuts, Screws, Rivets, & Washers
- 346 Metal Forgings & Stampings
- 347 Coating, Engraving, & Allied Services
- 348 Ordnance & Accessories, Except Vehicles & Guided Missiles
- 349 Miscellaneous Fabricated Metal Products

35. Machinery, Except Electrical
- 351 Engines & Turbines
- 352 Farm & Garden Machinery & Equipment
- 353 Construction, Mining, & Materials Handling Machinery & Equipment
- 354 Metalworking Machinery & Equipment
- 355 Special Industry Machinery, Except Metalworking Machinery
- 356 General Industrial Machinery & Equipment
- 357 Office, Computing, & Accounting Machines
- 358 Refrigeration & Service Industry Machinery
- 359 Miscellaneous Machinery, Except Electrical

36. Electrical & Electronic Machinery, Equipment, & Supplies
- 361 Electric Transmission & Distribution Equipment
- 362 Electrical Industrial Apparatus
- 363 Household Appliances
- 364 Electric Lighting & Wiring Equipment
- 365 Radio & Television Receiving Equipment, Except Communication Types
- 366 Communication Equipment
- 367 Electronic Components & Accessories
- 369 Miscellaneous Electrical Machinery, Equipment, & Supplies

37. Transportation Equipment
- 371 Motor Vehicles & Motor Vehicle Equipment
- 372 Aircraft & Parts
- 373 Ship & Boat Building & Repairing
- 374 Railroad Equipment
- 375 Motorcycles, Bicycles, & Parts
- 376 Guided Missiles & Space Vehicles & Parts
- 379 Miscellaneous Transportation Equipment

38. Measuring, Analyzing, & Controlling Instruments; Photographic, Medical, & Optical Goods; Watches & Clocks
- 381 Engineering, Laboratory, Scientific, & Research Instruments, & Associated Equipment
- 382 Measuring & Controlling Instruments
- 383 Optical Instruments & Lenses
- 384 Surgical, Medical, & Dental Instruments & Supplies
- 385 Ophthalmic Goods
- 386 Photographic Equipment & Supplies
- 387 Watches, Clocks, Clockwork Operated Devices, & Parts

40. Railroad Transportation
- 401 Railroads
- 404 Railway Express Service

41. Local & Suburban Transit & Interurban Highway Passenger Transportation
- 411 Local & Suburban Passenger Transportation
- 413 Intercity & Rural Highway Passenger Transportation

43. U.S. Postal Service

44. Water Transportation
- 441 Deep Sea Foreign Transportation
- 442 Deep Sea Domestic Transportation
- 444 Transportation on Rivers & Canals
- 445 Local Water Transportation
- 446 Services Incidental to Water Transportation

45. Transportation By Air
- 451 Air Transportation, Certificated Carriers
- 452 Air Transportation, Noncertificated Carriers
- 458 Fixed Facilities & Services Related to Air Transportation

46. Pipe Lines, Except Natural Gas

48. Communication
- 481 Telephone Communication (Wire or Radio)
- 482 Telegraph Communication (Wire or Radio)
- 483 Radio & Television Broadcasting
- 489 Communication Services, Not Elsewhere Classified

49. Electric, Gas, & Sanitary Services
- 491 Electric Services
- 492 Gas Production & Distribution
- 493 Combination Electric & Gas, & Other Utility Services
- 494 Water Supply
- 495 Sanitary Services
- 496 Steam Supply
- 497 Irrigation Systems

60. Banking
- 601 Federal Reserve Banks
- 602 Commerical & Stock Savings Banks
- 603 Mutual Savings Banks
- 604 Trust Companies Not Engaged in Deposit Banking
- 605 Establishments Performing Functions Closely Related To Banking

61. Credit Agencies Other Than Banks
- 611 Rediscount & Financing Institutions for Credit Agencies Other Than Banks
- 612 Savings & Loan Associations
- 613 Agricultural Credit Institutions
- 614 Personal Credit Institutions
- 615 Business Credit Institutions
- 616 Mortgage Bankers & Brokers

62. Security & Commodity Brokers, Dealers, Exchanges, & Services
- 621 Security Brokers, Dealers, & Flotation Companies
- 622 Commodity Contracts Brokers & Dealers
- 623 Security & Commodity Exchanges
- 628 Services Allied With the Exchange of Securities or Commodities

63. Insurance
- 631 Life Insurance
- 632 Accident & Health Insurance & Medical Service Plans
- 633 Fire, Marine, & Casualty Insurance
- 635 Surety Insurance
- 636 Title Insurance
- 637 Pension, Health, & Welfare Funds
- 639 Insurance Carriers, Not Elsewhere Classified

65. Real Estate
- 651 Real Estate Operators (Except Developers) and Lessors
- 653 Real Estate Agents & Managers
- 654 Title Abstract Offices
- 655 Subdividers & Developers

66. Combinations of Real Estate, Insurance, Loans, Law Offices

67. Holding & Other Investment Offices
- 671 Holding Offices
- 672 Investment Offices
- 673 Trusts
- 679 Miscellaneous Investing

70. Hotels, Rooming Houses, Camps, & Other Lodging Places
- 701 Organization Hotels & Lodging Houses, on Membership Basis

73. Business Services
- 731 Advertising
- 733 Mailing, Reproduction, Commercial Art & Photography, & Stenographic Services
- 734 Services to Dwellings & Other Buildings
- 737 Computer & Data Processing Services
- 739 Miscellaneous Business Services

78. Motion Pictures
- 781 Motion Picture Production & Allied Services

79. Amusement & Recreation Services, Except Motion Pictures
- 794 Commercial Sports
- 799 Miscellaneous Amusement & Recreation Services

80. Health Services
- 801 Offices of Physicians
- 802 Offices of Dentists
- 803 Offices of Osteopathic Physicians
- 804 Offices of Other Health Practitioners
- 805 Nursing & Personal Care Facilities
- 806 Hospitals
- 807 Medical & Dental Laboratories
- 808 Outpatient Care Facilities
- 809 Health & Allied Services, Not Elsewhere Classified

81. Legal Services

83. Social Services
- 832 Individual & Family Social Services
- 839 Social Services, Not Elsewhere Classified

84. Museums, Art Galleries, Botanical & Zoological Gardens
- 841 Museums & Art Galleries
- 842 Arboreta, Botanical & Zoological Gardens

86. Membership Organizations
- 861 Business Associations
- 862 Professional Membership Organizations
- 863 Labor Unions & Similar Labor Organizations
- 864 Civic, Social, & Fraternal Associations
- 865 Political Organizations
- 866 Religious Organizations
- 869 Membership Organizations, Not Elsewhere Classified

89. Miscellaneous Services
- 891 Engineering, Architectural, & Surveying Services
- 892 Noncommercial Educational, Scientific, & Research Organizations
- 899 Services, Not Elsewhere Classified

91. Executive, Legislative, & General Government, Except Finance
- 911 Executive Offices
- 912 Legislative Bodies
- 913 Executive & Legislative Offices Combined
- 919 General Government, Not Elsewhere Classified

92. Justice, Public Order, & Safety
- 921 Courts
- 922 Public Order & Safety

93. Public Finance, Taxation, & Monetary Policy

94. Administration of Human Resources Programs
- 941 Administration of Educational Programs
- 943 Administration of Public Health Programs
- 944 Administration of Social, Manpower, & Income Maintenance Programs
- 945 Administration of Veterans' Affairs, Except Health & Insurance

95. Administration of Environmental Quality & Housing Programs
- 951 Administration of Environmental Quality Programs
- 953 Administration of Housing & Urban Development Programs

96. Administration of Economic Programs
- 961 Administration of General Economic Programs
- 962 Regulation & Administration of Transportation Programs
- 963 Regulation & Administration of Communication, Electric, Gas, & Other Utilities
- 964 Regulation of Agricultural Marketing & Commodities
- 965 Regulation, Licensing, & Inspection of Miscellaneous Commercial Sectors
- 966 Space Research & Technology

97. National Security & International Affairs
- 971 National Security
- 972 International Affairs

99. Nonclassifiable Establishments

AGRICULTURE

01. Agribusiness and Agricultural Productions

01.01 Agricultural Business and Management
- 01.0101 Agricultural Business & Management, General
- 01.0102 Agricultural Business
- 01.0103 Agricultural Economics
- 01.0104 Farm and Ranch Management
- 01.0199 Agricultural Business & Management, Other

01.02 Agricultural Mechanics
- 01.0201 Agricultural Mechanics, General
- 01.0202 Agricultural Electrification, Power, & Controls
- 01.0203 Agricultural Mechanics, Construction, & Maintenance Skills
- 01.0204 Agricultural Power Machinery
- 01.0205 Agricultural Structures, Equipment, and Facilities
- 01.0206 Soil & Water Mechanical Practices
- 01.0299 Agricultural Mechanics, Other

01.03 Agricultural Production
- 01.0301 Agricultural Production, General
- 01.0302 Animal Production
- 01.0303 Aquaculture
- 01.0304 Crop Production
- 01.0305 Game Farm Management
- 01.0399 Aricultural Production, Other

01.04 Agricultural Products and Processing
- 01.0401 Agricultural Products & Processing, General
- 01.0402 Food Products
- 01.0403 Nonfood Products
- 01.0499 Agricultural Products & Processing, Other

01.06 Horticulture
- 01.0601 Horticulture, General
- 01.0602 Arboriculture
- 01.0603 Floriculture
- 01.0604 Greenhouse Operation & Management
- 01.0605 Landscaping
- 01.0606 Nursery Operation & Management
- 01.0607 Turf Management
- 01.0699 Horticulture, Other

02. Agricultural Sciences

02.02 Animal Sciences
- 02.0201 Animal Sciences, General
- 02.0202 Animal Breeding & Genetics
- 02.0203 Animal Health
- 02.0204 Animal Nutrition
- 02.0205 Animal Physiology
- 02.0206 Dairy
- 02.0207 Fisheries Science
- 02.0208 Livestock
- 02.0209 Poultry
- 02.0299 Animal Sciences, Other

02.03 Food Sciences
- 02.0301 Food Sciences, General
- 02.0302 Dairy Processing
- 02.0303 Food Distribution
- 02.0304 Food Engineering
- 02.0305 Food Packaging
- 02.0306 Food Technology
- 02.0399 Food Sciences, Other

02.04 Plant Sciences
- 02.0401 Plant Sciences, General
- 02.0402 Agronomy
- 02.0403 Horticulture Science
- 02.0404 Ornamental Horticulture
- 02.0405 Plant Breeding & Genetics
- 02.0406 Plant Pathology (Applied)
- 02.0407 Plant Physiology
- 02.0408 Plant Protection (Pest Management)
- 02.0409 Range Management
- 02.0410 Turf Management Science
- 02.0499 Plant Sciences, Other

02.05 Soil Sciences
- 02.0501 Soil Sciences, General
- 02.0502 Soil Chemistry
- 02.0503 Soil Conservation
- 02.0504 Soil Management & Fertility
- 02.0505 Soil Microbiology
- 02.0506 Soil Physics
- 02.0599 Soil Sciences, Other

02.99 Agricultural Sciences, Other

03. Renewable Natural Resources

03.01 Renewable Natural Resources, General
- 03.0101 Renewable Natural Resources, General

03.02 Conservation and Regulation
- 03.0201 Conservation & Regulation, General
- 03.0202 Conservation
- 03.0203 Resources Protection & Regulation
- 03.0299 Conservation & Regulation, Other

03.04 Forestry Production & Processing
- 03.0401 Forestry Production & Processing, General
- 03.0402 Forest Production
- 03.0403 Forest Products Utilization
- 03.0404 Forest Products Processing Technology
- 03.0405 Logging
- 03.0406 Pulp & Paper Production
- 03.0499 Forestry Production & Processing, Other

03.05 Forestry & Related Sciences
- 03.0501 Forestry & Related Sciences, General
- 03.0502 Forestry Science
- 03.0503 Forest Biology
- 03.0504 Forest Engineering
- 03.0505 Forest Hydrology
- 03.0506 Forest Management
- 03.0507 Forest Mensuration
- 03.0508 Urban Forestry
- 03.0509 Wood Science
- 03.0599 Forestry & Related Sciences, Other

03.06 Wildlife Management

03.99 Renewable Natural Resources, Other

ARCHITECTURE & ENVIRONMENTAL DESIGN

04. Architecture & Environmental Design

04.01 Architecture & Environmental Design, General

04.02 Architecture

04.03 City, Community, & Regional Planning

04.04 Environmental Design

04.05 Interior Design

04.06 Landscape Architecture

04.07 Urban Design

04.99 Architecture & Environmental Design, Other

BUSINESS

06. Business & Management

06.01 Business & Management, General

06.02 Accounting

06.03 Banking & Finance

06.04 Business Administration & Management
- 06.0401 Business Administration & Management, General
- 06.0402 Contract Management & Procurement/ Purchasing
- 06.0403 Product Management
- 06.0404 Systems Efficiency Analysis
- 06.0499 Business Administration & Management, Other

06.05 Business Economics

06.06 Human Resources Development

06.07 Institutional Management

06.08 Insurance & Risk Management

06.09 International Business Management

06.10 Investments & Securities

06.11 Labor/Industrial Relations

06.12 Management Information Systems

06.13 Management Science
- 06.1301 Business Statistics
- 06.1302 Operations Research (Quantitative Methods)
- 06.1399 Management Science, Other

06.14 Marketing Management & Research
- 06.1401 Marketing Management
- 06.1402 Marketing Research
- 06.1499 Marketing Management & Research, Other

06.15 Organizational Behavior

06.16 Personnel Management

06.14 Real Estate
- 06.1701 Real Estate, General
- 06.1702 Commercial Property
- 06.1703 Property Management
- 06.1704 Real Estate Appraisal
- 06.1705 Real Estate Finance
- 06.1706 Real Estate Law
- 06.1707 Residential Property
- 06.1707 Residential Property
- 06.1799 Real Estate, Other

06.18 Small Business Management & Ownership
- 06.1801 Small Business Management
- 06.1802 Small Business Ownership
- 06.1899 Small Business Management & Ownership, Other

06.19 Taxation

06.20 Trade & Industrial Supervision & Management

06.99 Business & Management, Other

07. Business & Office

07.01 Accounting, Bookkeeping, & Related Programs

07.03 Business Data Processing & Related Programs

07.05 Personnel & Training Programs

07.99 Business & Office, Other

08. Marketing & Distribution

08.01 Apparel & Accessories Marketing

08.02 Business & Personal Services Marketing

08.03 Entrepreneurship

03.04 Financial Services Marketing

03.06 Food Marketing

08.08 Home & Office Products Marketing

08.09 Hospitality & Recreation Marketing

08.10 Insurance Marketing

08.11 Transportation & Travel Marketing

08.12 Vehicles & Petroleum Marketing

08.99 Marketing & Distribution, Other

COMMUNICATIONS

09. Communications

09.01 Communications, General

09.02 Advertising

09.03 Communications Research

09.04 Journalism (Mass Communications)

09.05 Public Relations

09.06 Radio/Television News Broadcast

09.07 Radio/Television, General

09.99 Communications, Other

10. Communication Technologies

10.01 Communication Technologies
- 10.0101 Educational Media Technology
- 10.0102 Motion Picture Technology
- 10.0103 Photographic Technology
- 10.0104 Radio & Television Production & Broadcasting Technology
- 10.0199 Communication Technologies, Other

COMPUTER & INFORMATION SCIENCES

11. Computer & Information Sciences

11.01 Computer & Information Sciences, General

11.02 Computer Programming

11.03 Data Processing

11.04 Information Sciences & Systems

11.05 Systems Analysis

11.99 Computer & Information Sciences, Other

ENGINEERING

14. Engineering

14.01 Engineering, General

14.02 Aerospace, Aeronautical, & Astronautical Engineering

14.03 Agricultural Engineering

14.04 Architectural Engineering

14.05 Bioengineering & Biomedical Engineering

14.06 Ceramic Engineering

14.07 Chemical Engineering

14.08 Civil Engineering

14.09 Computer Engineering

14.10 Electrical, Electronics, & Communications Engineering

14.11 Engineering Mechanics

14.12 Engineering Physics

14.13 Engineering Science

14.14 Environmental Health Engineering

14.15 Geological Engineering

14.16 Geophysical Engineering

14.17 Industrial Engineering

14.18 Materials Engineering

14.19 Mechanical Engineering

14.20 Metallurgical Engineering

14.21 Mining & Mineral Engineering

14.22 Naval Architecture & Marine Engineering

14.23 Nuclear Engineering

14.24 Ocean Engineering

14.25 Petroleum Engineering

14.26 Surveying & Mapping Sciences
- 14.2601 Surveying & Mapping Sciences
- 14.2602 Cartography

14.27 Systems Engineering

14.28 Textile Engineering

14.99 Engineering, Other

HEALTH

17. Allied Health

17.01 Dental Services

17.02 Diagnostic & Treatment Services
- 17.0201 Cardiopulmonary Technology
- 17.0202 Dialysis Technology
- 17.0203 Electrocardiograph Technology
- 17.0204 Electroencephalograph Technology
- 17.0205 Emergency Medical Technology-Ambulance
- 17.0206 Emergency Medical Technology-Paramedic
- 17.0207 Medical Radiation Dosimetry
- 17.0208 Nuclear Medical Technology
- 17.0209 Radiograph Medical Technology
- 17.0210 Respiratory Therapy Technology
- 17.0211 Surgical Technology
- 17.0212 Ultrasound Technology

17.03 Medical Laboratory Technologies
- 17.0301 Blood Bank Technology
- 17.0302 Chemistry Technology
- 17.0303 Clinical Animal Technology
- 17.0306 Cytotechnology
- 17.0307 Hemotology Technology
- 17.0308 Histologic Technology
- 17.0309 Medical Laboratory Technology
- 17.0310 Medical Technology
- 17.0311 Microbiology Technology
- 17.0399 Medical Laboratory Technologies, Other

17.04 Mental Health/Human Services

17.06 Nursing Related Services

17.07 Ophthalmic Services

17.08 Rehabilitation Services

17.99 Allied Health, Other

18. Health Sciences

18.01 Audiology & Speech Pathology
- 18.0101 Audiology
- 18.0102 Speech Pathology
- 18.0103 Speech Pathology/Audiology
- 18.0199 Audiology & Speech Pathology, Other

18.02 Basic Clinical Health Sciences
- 18.0201 Clinical Anatomy
- 18.0202 Clinical Biochemistry
- 18.0203 Clinical Microbiology
- 18.0204 Clinical Pathology
- 18.0205 Physiology
- 18.0299 Basic Clinical Health Sciences, Other

18.04 Dentistry
- 18.0401 Dentistry, General
- 18.0402 Dental Public Health
- 18.0403 Endodontics
- 18.0404 Oral/Maxial Facial Surgery
- 18.0405 Oral Pathology
- 18.0406 Orthodontics
- 18.0407 Pedodontics
- 18.0408 Periodontics
- 18.0409 Prosthodontics
- 18.0499 Dentistry, Other

18.05 Emergency/Disaster Science

18.06 Epidemiology

18.07 Health Sciences Administration
- 18.0701 Health Care Administration
- 18.0702 Health Care Planning
- 18.0703 Medical Records Administration
- 18.0799 Health Sciences Administration Other

18.08 Hematology

18.09 Medical Laboratory

18.10 Medicine
- 18.1001 Medicine, General
- 18.1002 Allergies & Endomology
- 18.1003 Anesthesiology
- 18.1004 Colon & Rectal Surgery
- 18.1005 Dermatology
- 18.1006 Emergency Medicine
- 18.1007 Family Practice
- 18.1008 Geriatrics
- 18.1009 Immunology
- 18.1010 Internal Medicine
- 18.1011 Neurological Surgery
- 18.1012 Nuclear Medicine
- 18.1013 Obstetrics & Gnyecology
- 18.1014 Ophthalmology
- 18.1015 Orthodontic Surgery
- 18.1016 Orthopedic
- 18.1017 Otorhinolaryngology/Otolaryngology
- 18.1018 Pathology
- 18.1019 Pediatrics
- 18.1020 Physical Medicine & Rehabilitation
- 18.1021 Plastic Surgery
- 18.1022 Preventive Medicine
- 18.1023 Psychiatry
- 18.1024 Neurology
- 18.1025 Radiology
- 18.1026 Surgery
- 18.1027 Thoracic Surgery
- 18.1028 Urology
- 18.1099 Medicine, Other

18.11 Nursing
- 18.1101 Nursing, General
- 18.1102 Anesthetist
- 18.1103 Maternal/Child Health
- 18.1104 Medical Surgical
- 18.1105 Nursing Administration
- 18.1106 Psychiatric/Mental Health
- 18.1107 Public Health
- 18.1199 Nursing, Other

18.12 Optometry

18.13 Osteopathic Medicine

18.14 Pharmacy

18.15 Podiatry

18.16 Population & Family Planning

18.22 Public Health Laboratory Science

18.23 Toxicology (Clinical)

18.24 Veterinary Medicine

18.99 Health Sciences, Other

HOME ECONOMICS

19. Home Economics

19.01 Home Economics, General

19.02 Business Home Economics

19.03 Family & Community Services

19.04 Family/Consumer Resource Management

19.05 Food Sciences & Human Nutrition
- 19.0501 Food Sciences & Human Nutrition, General
- 19.0502 Food/Food Sciences
- 19.0503 Dietietics/Human Nutritional Services
- 19.0504 Human Nutrition
- 19.0599 Food Sciences & Human Nutrition, Other

LAW

22. Law

22.01 Law

Life Sciences

26. Life Sciences

26.01 Biology, General

26.02 Biochemistry & Biophysics

26.03 Botany
- 26.0301 Botany, General
- 26.0302 Bacteriology
- 26.0303 Mycology
- 26.0304 Plant Genetics
- 26.0305 Plant Pathology
- 26.0306 Plant Pharmacology
- 26.0307 Plant Physiology
- 26.0399 Botany, Other

26.04 Cell & Molecular Biology
- 26.0401 Cell Biology
- 26.0402 Molecular Biology
- 26.0499 Cell & Molecular Biology, Other

26.05 Microbiology

26.06 Miscellaneous Specialized Areas, Life Sciences
- 26.0601 Anatomy
- 26.0602 Biometrics & Biostatistics
- 26.0603 Ecology
- 26.0604 Embryology
- 26.0605 Endocrinology
- 26.0606 Histology
- 26.0607 Marine Biology
- 26.0608 Neurosciences
- 26.0609 Nutritional Sceinces
- 26.0610 Parasitology
- 26.0611 Radiobiology
- 26.0612 Toxicology
- 26.0699 Miscellaneous Specialized Areas, Life Sciences, Other

26.07 Zoology
- 26.0701 Zoology, General
- 26.0702 Entomology
- 26.0703 Genetics, Human & Animal
- 26.0704 Pathology, Human & Animal
- 26.0705 Pharmacology, Human & Animal
- 26.0706 Physiology, Human & Animal
- 26.0799 Zoology, Other

26.99 Life Sciences, Other

MATHEMATICS

27. Mathematics

27.01 Mathematics, General

27.02 Actuarial Sciences

27.03 Applied Mathematics

27.04 Pure Mathematics

27.05 Statistics

27.99 Mathematics, Other

MILITARY SCIENCES

28. Military Sciences

28.01 Aerospace Science (Air Force)
- 28.0101 Aerospace Science (Air Force)

28.02 Coast Guard Science
- 28.0201 Coast Guard Science

28.03 Military Science (Army)
- 38.0301 Military Science (army)

28.04 Naval Science (Navy, Marines)
- 28.0401 Naval Science (Navy, Marines)

28.99 Military Sciences, Other
- 28.9999 Military Sciences, Other

MULTI/INTERDISCIPLINARY STUDIES

30. Multi/Interdisciplinary Studies

30.01 Biological & Physical Sciences
- 30.0101 Biological & Physical Sciences

30.03 Engineering & Other Disciplines
- 30.0301 Engineering & Other Discipline

30.06 Systems Science
- 30.0601 Systems Science

PHYSICAL SCIENCES

40. Physical Sciences

40.01 Physical Sciences, General

40.02 Astronomy

40.03 Astrophysics

40.04 Atmospheric Sciences & Meteorology

40.05 Chemistry
- 40.0501 Chemistry, General
- 40.0502 Analytical Chemistry
- 40.0503 Inorganic Chemistry
- 40.0504 Organic Chemistry
- 40.0505 Pharmaceutical Chemistry
- 40.0506 Physical Chemistry
- 40.0599 Chemistry, Other

40.06 Geological Sciences
- 40.0601 Geology
- 40.0602 Geochemistry
- 40.0603 Geophysics & Seismology
- 40.0604 Paleontology
- 40.0699 Geological Sciences, Other

40.07 Miscellaneous Physical Sciences

40.0701 Metallurgy
40.0702 Oceanography
40.0703 Earth Science
40.0799 Miscellaneous Physical Sciences, Other

40.08 Physics
40.0801 Physics, General
40.0802 Atomic/Molecular Physics
40.0802 Electron Physics
40.0804 Elementary Particle Physics
40.0805 Fluids & Plasmas
40.0806 Nuclear Physics
40.0807 Optics
40.0808 Solid State Physics
40.0899 Physics, Other

40.09 Planetary Science

40.99 Physical Sciences, Other

PSYCHOLOGY

42. Psychology

42.01 Psychology, General

42.02 Clinical Psychology

42.03 Cognitive Psychology

42.04 Community Psychology

42.05 Comparative Psychology

42.06 Counseling Psychology

42.07 Developmental Psychology

42.08 Experimental Psychology

42.09 Industrial & Organizational Psychology

42.10 Personality Psychology

42.11 Physiological Psychology

42.12 Psycholinguistics

42.13 Psychometrics

42.14 Psychopharmacology

42.15 Quantitative Psychology

42.16 Social Psychology

42.99 Psychology, Other

PUBLIC AFFAIRS & PROTECTIVE SERVICES

43. Protective Services

43.02 Fire Protection

44. Public Affairs

44.01 Public Affairs, General

44.02 Community Services

44.03 International Public Service

44.04 Public Administration

44.05 Public Policy Studies

44.06 Public Works

44.07 Social Work
44.0701 Social Work, General
44.0702 Medical Social Work
44.0799 Social Work, Other

44.99 Public Affairs, Other

SOCIAL SCIENCES

45. Social Sciences

45.05 Demography
45.0501 Demography

45.06 Economics
45.0601 Economics

45.07 Geography
45.0701 Geography

45.09 International Relations
45.0901 International Relations

45.10 Political Science & Government
45.1001 Political Science & Government

45.11 Sociology
45.1101 Sociology

45.12 Urban Studies
45.1201 Urban Studies

PENNSYLVANIA RESEARCH INVENTORY PROJECT

1. Name of Company_____

2. Title of Research & Development Unit_____

3. Director of Research and Development Unit_____

4. Mailing Address_____

5. Telephone_____

6. Briefly describe the major focus of the unit.

_____

_____

_____

_____

7. Using the attached lists, select the numerical category that best describes the research and development unit. Enter the number(s) for that category on the lines below. If more than one code number applies then list in order of importance.

NATIONAL CENTER FOR EDUCATION STATISTICS (N.C.E.S.) DISCIPLINE AND/OR FIELD CODES:

__.____ __.____ __.____

STANDARD INDUSTRIAL CODES (S.I.C.):

___ ___ ___

8. List those key words usually used to best describe the activities, products, or outcomes of the research and development unit.

_____ _____ _____

9. Personnel:

Number of Research Professionals _____

Number of Supporting Professionals_____

Number of technical staff (lab assistants, graduate assistants, technicians) ___

Number of support staff (secretaries, administrators, etc.)_____

10. Approximate Annual Funding Level: _____

11. Special Equipment and/or Facilities:

Facilities _____

_____

Buildings _____

_____

Libraries and Collections _____

_____

Cooperative Arrangements _____

_____

12. Can your unit serve Pennsylvania's economic development program through contracted research, development, and consulting projects?

_____ Yes _____ No

Center for the Study of Higher Education
The Pennsylvania State University
325 Pond Laboratory
University Park, PA 16802
(814)865-6346

APPENDIX C

PENNSYLVANIA RESEARCH INVENTORY PROJECT

TELEPHONE SURVEY

1. Identify yourself: My name is_____. I am calling from the Center for the Study of Higher Education at The Pennsylvania State University. We are examining the research capacity in Pennsylvania and would like to know of similar efforts in other states.

2. Has your office generated any kind of a list of research capability?

   A. If yes:

      (1) Who is included?

      (2) What information is collected?

      (3) When/where was it done?

      (4) When is it updated?

      (5) Who has access to it?

      (6) Are printed copies available? If so - May we have one?

   B. If no:

      Has there been any discussion of such a study?

      If no:

      Where do you obtain this type of information?